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ESTABLISHED 1902

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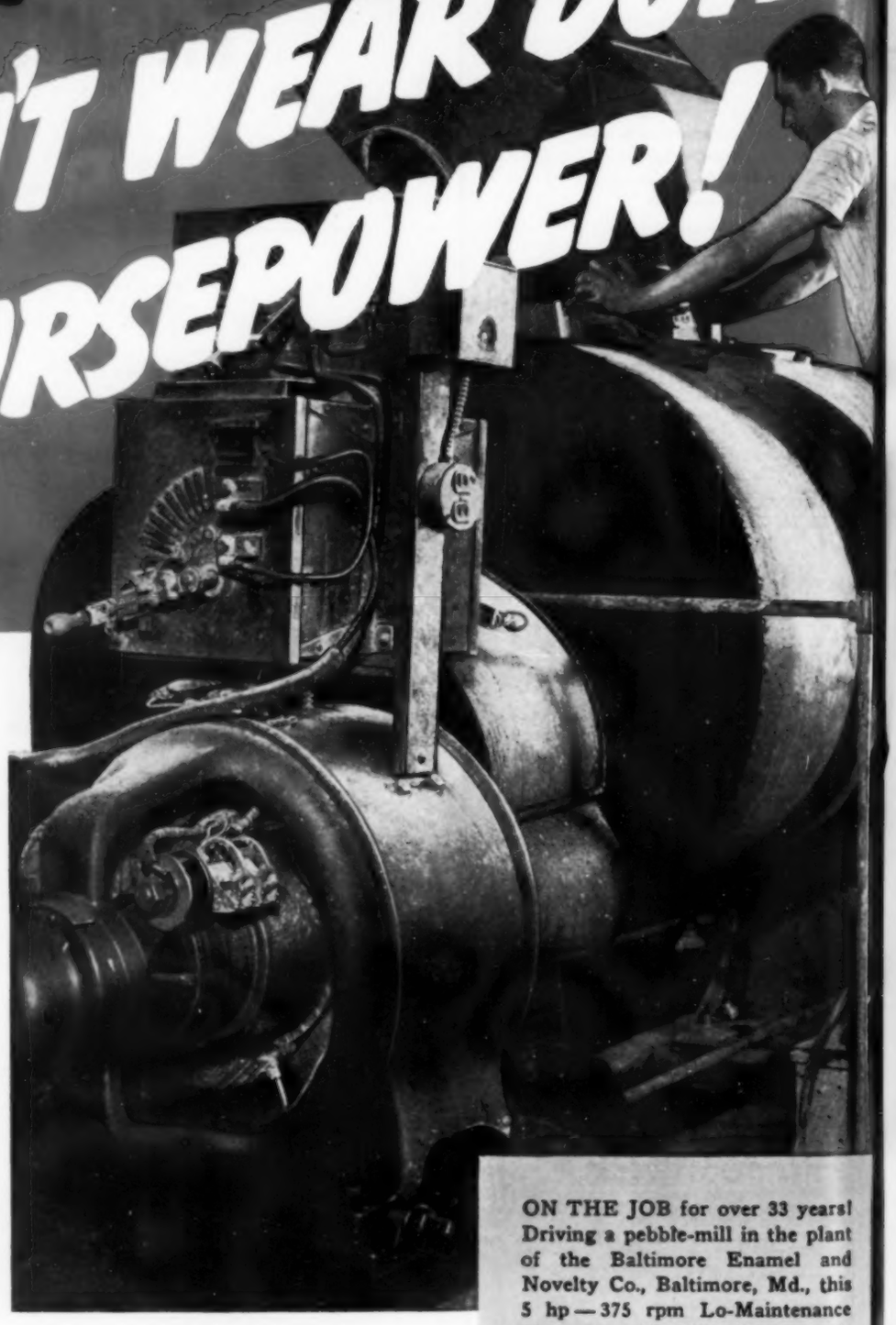

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S. D. KIRKPATRICK, Editor

OCTOBER, 1941

REVEILLE IN WASHINGTON

AT TIMES the "Battle of Washington" seems discouraging and almost hopeless. Boards and "offices" multiply. Staff changes occur faster than the mimeographing machines can turn out the new roster lists. Reserves of more and more "experts" are being rushed into the ranks of the bureaucrats. Priorities, pyramiding in geometric proportion, are fast becoming worse than useless. Meanwhile defense and supply problems of grave concern to chemical industries remain unsolved. Before it is too late, something must be done to bring order, direction and action into this confusing struggle.

The first encouraging development to come from the new general headquarters of Donald M. Nelson was his "clean the decks" order. He went back to his mail-order experience when he demanded that letters be answered and action taken within 48 hours. He drew on his scientific and engineering background when he ordered a thorough-going survey of both civilian and military needs and started to resolve these requirements into schedules of raw materials, labor and machinery needed for their production. He spoke realistically when he told the House Banking Committee on September 25 that the whole priorities system was fast breaking down of its own weight and would soon have to be replaced by specific allocation of materials and equipment instead of the preference ratings which have been so generously used and abused. These advances, even though they may be painful and disturbing, seem to be in the right direction.

In the chemical industry Mr. Nelson is going to find that this problem of cataloging the government's demands is far from simple. With Uncle Sam assuming more and more of John Bull's job, and at the same time constantly raising his own ratio of materiel to man-power, it is obvious that any one set of estimated requirements is not likely to be good for very long. But the mere listing itself is bound to prove helpful if he finds a way to get that information across in time to anticipate the dislocations and adjustments that must be made in the ranks of industry.

Any sudden change from priorities to allocation may have drastic repercussions in our field, but if developed slowly, step-by-step, most of the users of chemicals and chemical engineering equipment would probably welcome the new system. The principal difference, of course, is that under priorities the purchasers are given their preference ratings and told to get their goods if, where and when they can. Getting the priority order is comparatively simple, but getting the materials the order calls for is often difficult or impossible. Under the allocation system, however, the government deals primarily with the producers, telling them to whom they can sell, in what quantity, and when to deliver. Carried to extremes, it means absolute control of all raw materials and productive capacity. England came to it a few months ago just as did Germany early in 1939. If we must, let's hope it can be done intelligently!

In the meantime, of course, the priority system must be made to work if that is possible. It will still be with us to a certain extent even under allocations because decisions of urgency will have to be made among both military and civilian needs. Under any system, the guiding principle must be to find out exactly how much is needed, how much is available, and then make sure that what we have in the way of materials, machinery and man-power, can be stretched to do the job.

Fortunately, for all of us, these days of bewilderment and painful adjustment are coming at a time when the spirit of unity and enterprise is rising in this country. Paul Bunyan has heard the reveille and is beginning to awaken, to roll up his shirt-sleeves and to try out his muscles. With giant strides and boundless energy, he's going to Washington to take this defense job in his own hands. When he does, he's going to make it work!

FROM AN

RECOGNITION OF ACHIEVEMENT

SINCE early last Spring a large and distinguished committee of chemical engineering educators has been studying the recent technical accomplishments and personnel policies of leading companies in the chemical process industries. Its announced purpose has been to accord recognition to that organization which, through the participation of its chemical engineers, has contributed most to the advance of our industry and profession since December 1939.

Chairman Alfred H. White, who has served on this Committee of Award since its inception in 1933, reports that in no similar period in the past has there been so many significant achievements resulting from the coordinated group efforts of chemical engineers. Some important advances undoubtedly stem from the immediate demands of the national defense program. Others represent the constantly expanding influence and accomplishments of groups that have long been noted for the brilliance of their research and for their resourcefulness in engineering and management. Obviously the committee's task this year has not been easy nor has it taken its responsibilities lightly. Its decision should, therefore, be of interest to all chemical engineers.

By vote of this representative committee, the 1941 Award for Chemical Engineering Achievement is to go to the Dow Chemical Company for pioneering work in the development of its magnesium production processes which have recently culminated in the successful recovery of this metal from sea water in a great new plant in Freeport, Texas. Presentation of the Award will be made during the week of December 1 in connection with the Eighteenth Chemical Exposition in Grand Central Palace in New York City. Next month it will be our privilege to report in further detail on the recent achievements of this resourceful group.

We feel we speak for the entire profession when we extend to Dow's chemical engineers and executives our hearty congratulations. Likewise to Chairman White and the members of the Committee of Award, go our sincere thanks for the conscientious thought and effort they have invested in this well-deserved recognition of outstanding achievement.

PLANNING FOR SCARCITY

THERE will not be enough chemical raw materials for fertilizer manufacture next year. This is an unpleasant fact which the industry and government officials are just beginning to face. The shortage appears prospectively to be most serious with respect to nitrogen. With that in mind, some new policies are being formulated in Washington.

It is obvious that two possible remedies can be suggested for partial relief of this situation. In the first place, some types of crops can do fairly well without the normal quantities of nitrogen for a year or two. Officials of the industry and government are trying to work out plans for suggesting to farmers the ways in which fertilizer readjustment can be made to save nitrogen with a minimum of danger to crop output. In the second place, legumes can be grown to provide nitrogen as a part of the rotation of crops. More such effort must be made next year than ever before. This means that the legumes become more aggressive competitors of synthetic nitrogen than hitherto.

A great many varieties of chemical enterprise interested in nitrogen compounds are going to be affected by these developments. It is important that all of their executives think twice before they speak too freely on this subject. There is no cure-all for the situation that is developing. Somebody is going to take less nitrogen than he wants. It would be very wise if all interested parties are quite temperate in their interpretations of the situation, which has developed mainly because of the stupendous increase in explosives manufacture, an increase far beyond the wildest forecasts of the extreme militarists of a year ago. No one is really to blame. All parties will have to share in the burden. But neither hoarding nor cut-throat action on nitrogen supply is the right answer.

TOO MANY PLANTS STARTED?

WASHINGTON is now confronted by a new sort of priority problem. Officials seem deeply concerned. Actually, they have no one but themselves to blame. Here is the situation:

Each Washington office seeking to have certain plans speeded up has been granting priorities for scarce materials of construction. Perhaps too many new plants have been started. The more priorities granted, the less progress there is being made.

There appears no easy remedy for the chemical

EDITORIAL VIEWPOINT

enterprise which is trying to expand its business to meet urgent government demand. The only thing to do is to seek a higher priority rating for each job. But pretty soon this will do no good. Actually, many shops are so full of AA and A-1-a priorities that an A-2 or A-3 is just about useless at this time.

It is easy to advise that each one seeking a priority should be very conservative and ask for nothing more than he must absolutely have to carry on the most essential defense effort. But most of us are not built that way. We are going to keep on asking for the highest priority we can get, each of us individually. But we might as well face the fact that the whole system is going to break down pretty soon.

Then what? Frankly, we do not know.

CHEMICAL PRICE FREEZING

COOPERATION with chemical manufacturers is evident in the price control policy of Washington. This is the industry's reward for a sound price policy of years standing. It shows that the government appreciates the ever-continuing effort of chemical makers to lower costs by improved methods and to share the resulting benefits with their customers.

Other important morals could be drawn from recent actions in fixing price ceilings. But none is so conspicuous as is the meaning of the criticism of price profiteers which accompanied the announcement of the prosecution of certain chemical firms for over-pricing their goods. The announcement that the Justice Department was taking anti-trust action against "priority profiteers" spotlighted the fact that practically all the firms being haled into court are brokers who have been in business less than a year. It is the newcomer who has rushed into the market, attempting to make a quick profit out of temporary difficulties, that has caused any necessity for price actions.

Most chemical purchasers who pay too much for goods have no one but themselves to blame. If they have a legitimate need for a chemical, they can generally get it, no matter how scarce it may be. OPM is making particular arrangements to care for small companies needing small quantities of scarce commodities.

"It takes two to make a bargain." And it also takes two to make a bad profiteering deal. Washington has no sympathy for concerns who patronize the priority profiteers. As a matter of fact, some purchasers, as well as some sellers, are likely to find themselves in trouble. It should not be forgotten that the government can not only seize the goods found diverted from legitimate channels, but also can shut off other raw materials, transport, labor, or power from firms who violate the law. And some of the government executives are getting roused quite enough to use these economic sanctions. Extra-legal buying may prove as dangerous as attempted profiteering.

MOBILIZING ENGINEERING

TO MEET the present emergency, six national engineering societies, including the American Institute of Chemical Engineers, have joined in organizing the Engineers' Defense Board in order to provide a central agency that will be prepared to assist the various branches of the Government with engineering knowledge and experience on questions connected with military preparedness. Among the functions outlined for this new organization will be:

(1) To serve as a channel to inform engineers generally regarding defense problems, especially those involving shortages of materials;

(2) To implement and make applicable reports and recommendations of the advisory committees of the National Academy of Sciences;

(3) To urge engineers (a) to adopt procedures looking toward accomplishment of the objectives of defense agencies; (b) to promote means of increasing production of raw materials in which shortages exist; (c) to conserve the supply of industrial materials; (d) to find substitutes; and (e) to simplify operations and production;

(4) To act as a clearing house between engineers or engineering groups for information regarding substitute materials, waste prevention and conservation;

(5) To appoint, on request of the Army, Navy or other defense agency, special committees of engineers to deal with specific engineering problems related to defense; and

(6) To select problems or projects dealing with defense and to study them with due regard to activities of existing agencies.

Here then is a new agency of private enterprise to make this country's engineering materials and resources more effective in the present emergency. We shall hear more about it in the near future. Meanwhile let the Board's secretary, Dr. A. B. Parsons, 29 West 39th St., New York, know of any of your problems or suggestions on which united engineering action can help speed the defense effort.

How a Peace-Time Industry Is Preparing For Total-Defense Production

THEODORE R. OLIVE *Associate Editor, Chemical & Metallurgical Engineering*

Chem. & Met. INTERPRETATION

Most industries today are encountering difficulties with raw material and equipment supply, shortages of trained personnel, and uncertainty of future markets. Plants specializing in consumer goods face still more complex problems, in possible curtailment as shortages become more severe. Armstrong Cork Co., although much of its peace-time business is in civilian lines, is a concern determined not to be caught napping, come what may. The steps which the company is taking to meet possible contingencies are described here for the assistance of other concerns with similar problems.—*Editors.*

NOW THAT the United States is definitely gearing for total defense, many industries are anticipating or are already facing difficulties which have not arisen since the war of 1914-18, and perhaps not even then. Most managements have a four-part problem. They must find substitutes for cut-off supplies; develop modified or more efficient processes for critical items; and secure and train men for stepped-up operations and to replace those taken by the Services. In addition, if responsibilities to employees and stockholders are to be discharged by those facing possible curtailment of their normal lines, then every available means must be explored for shifting to types of production that will not be curtailed.

It was considerations such as these that led the Armstrong Cork Co. to develop the defense policies now being pursued. For example: (1) Among the company's most important raw materials, several are imported and hence dependent on the availability of shipping, which leads to problems of substitution. (2) Many of the company's products, such as insulations and gasketing materials, are vital for defense and have increased tremendously in demand, requiring more intensive operation, with facilities augmented no more than absolutely necessary. (3) A highly skilled personnel is required in the majority of the company's operations and a considerable manpower increase has had to be met. (4) Finally, Armstrong manufactures a widely diversified line of products, a considerable number of which are consumed largely in the civilian field, which introduces the possibility of eventual curtailment.

MEETING THE PROBLEM

Fortunately for the company, solution of the first three parts of the problem was well under way before the onset of the emergency. Armstrong laboratories had already worked out satisfactory substitutes for several imported materials, such as burlap and tung oil, to guard against possible future unavailability. Inefficiencies had already been eliminated from the processes for making a number of products such as linoleum and insulating firebrick, permitting considerable increases in output without commensurate increases in working time, labor or equipment. Training policies which would allow the spreading of existing key personnel were already an old story with the company, making it readily possible to fill the shoes of men moved to other duties and provide the supervision for a 10 percent increase in personnel which was required during the first half of this year.

To understand how the company attacked the fourth problem, it is desirable to digress for a moment and examine briefly the development and present scope of the organization. At present the company has 17 domestic factories, as well as foreign subsidiaries in Canada, England, Spain, and Algeria. Organized in 1860 for the manufacture of stoppers and other natural cork specialties, Armstrong continued in this line and later also in the manufacture of numerous cork composition products until about 1922. Since that year, in addition to many new cork products, the company's output has been increased by numerous items in which no cork is used.

To mention a few of the last, products now manufactured include felt and felt-base floor coverings; molded and metal bottle closures; glass containers of all kinds; rubber and asphalt products for floor coverings; asphalt-base paints, fiberboard products and acoustic and vibration-absorbing materials.

Despite the fact that many of these products are obviously large-tonnage factors in the defense effort, Armstrong's management bore in mind Problem (4). As soon as the nature of the emergency became evident, the company immediately set up a war activities committee, composed of company officials who were charged with the responsibility of developing a program to help avert or offset major dislocations in activities.

The committee considered means of adapting present products to defense uses, and decided to seek prime contracts for shell manufacture, as well as sub-contracts for other defense materials which could be handled in the company's extensive and well organized shops. It decided to accord preference to all orders for defense goods, whether or not such orders carried mandatory government priorities; and it made a complete survey of all of the company's facilities, placing the information at the disposal of the government. Finally, it organized a new muni-

tions division of the company to produce defense goods outside the regular line of products, and to develop new defense products which could be turned out with existing facilities.

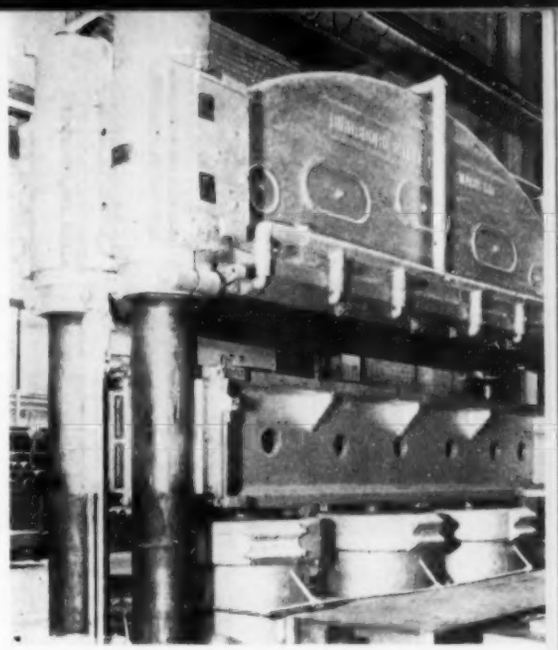
To those unfamiliar with Armstrong's training policy, this program may appear to introduce extremely complex problems from a personnel standpoint. This policy has been an important factor in permitting the company to branch quickly into lines hitherto unrelated to its business, and to replace top-ranking men taken from the company's various manufacturing divisions to coordinate defense activities. Furthermore, it has provided supervisors capable of training men formerly engaged in peace-time pursuits to carry on defense work of vastly different character.

For more than 20 years Armstrong has regularly interviewed senior students at many colleges and engineering schools. Those selected for employment from among the many students interviewed each year are put through a carefully planned training course lasting from nine months to 1½ years and designed to fit new employees for sales and supervisory positions. Furthermore, all supervisors are brought back to Lancaster for further training at regular three-year intervals. Thus the company is always staffed with men ready to step into larger responsibilities and it is rare indeed that an outsider must be brought in to fill a suddenly important vacancy.

An interesting byproduct of these training policies is evident in the organization of the shell shop at Lancaster. Immediately after receiving a War Department educational order for 75 mm. shells, the company called a selected group of employees to work in the new shell shop. These men for the most part were without previous machine tool experience—many of them being truck drivers, paint mixers and linoleum inspectors. Quickly they were taught to operate the dozen-odd precision tools used in shell machining. Although only trained machinists would ordinarily be called to such work, the success of the training which the company's supervisors were able to give is indicated by the exceptionally high record of perfects established on the educational order.

After this demonstration, three large orders for 75 mm. and 3-in. shells were awarded to the company, part of the order to be filled in the company's floor-division factory at Lancaster, the rest in the Pittsburgh factory where normally a wide variety of cork products is produced. Here again employee training played a decisive part. A picked group of Pittsburgh employees came to Lancaster and there learned the various machining operations from the recently instructed shell-shop workers. Upon achieving proficiency, these Pittsburgh men returned to their factory to help train other employees, with the result that several production lines are currently engaged in working on shell contracts.

Since many of Armstrong's factories are dependent on process operations, at first glance it might seem strange that the company should so readily be in a position to go into metal working as one of its new lines. The explanation lies in the excellence and extent of the company's machine shops which for many years have built a large part of the special equipment used in the domestic factories. Armstrong machinists, jig-, tool- and die-makers are accustomed to a degree of precision not often required in the metal-working industries. Thus the company has been able to secure sub-contract work on various defense equipment parts, while, through its willingness to invest in special machinery needed, it has received prime contracts on shells, including large recently awarded orders for 105 mm. chemical shells, 37 mm. brass shell casings and metal component parts for percussion fuse detonators.

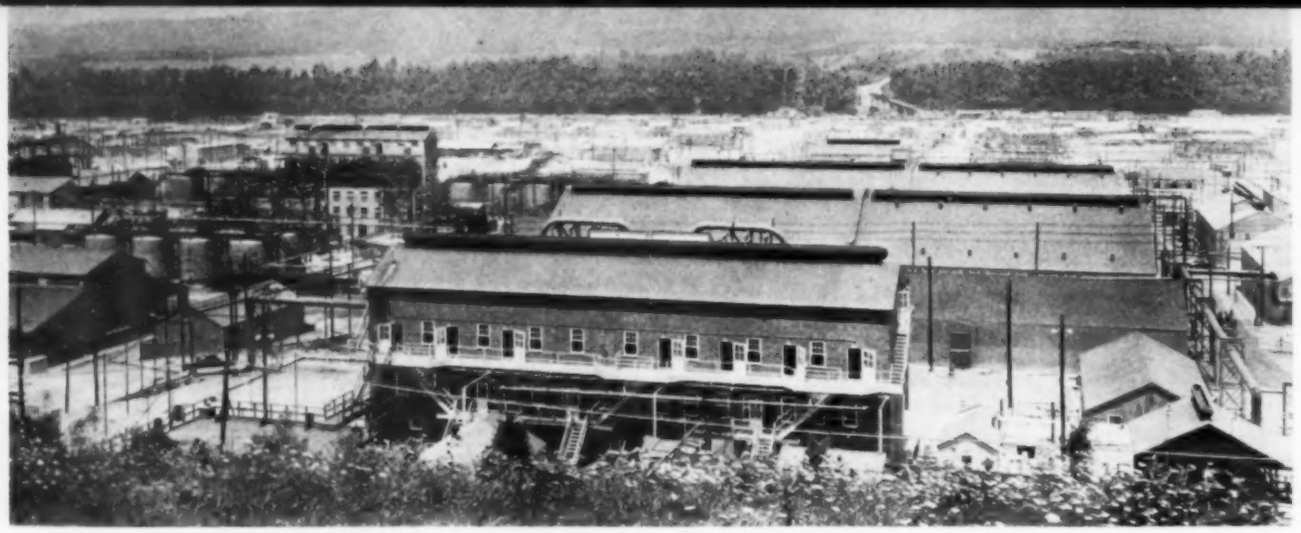


Here is a 3,500-ton linoleum press which has been converted to stamp out airplane wing tips

It is not the purpose of this article to explore in detail all of the paths into defense production being contemplated by Armstrong, but rather to explain a management philosophy which makes these departures possible. Suffice it to say that several new ventures are being considered, some of which display much ingenuity in adapting peace-time equipment to totally different sorts of defense production. Several of these ideas revolve around the company's large 3,500-ton linoleum presses. One such development which can be mentioned now is the stamping out of aluminum wing tips for airplanes under a sub-contract awarded by the Glenn L. Martin Co. Other uses will have to be left to future announcements.

Thus it will be seen that imagination is playing an important part in framing the company's present-day activities. How Armstrong's philosophy operates is perhaps best reflected in the way the company is employing its men, machines and management to insure the greatest possible contribution to defense, while at the same time guarding the interests of employees and stockholders alike.

Part of Armstrong's machine shop at Lancaster where sub-contracting is being carried out in numerous military items



Radford Ordnance Works: photograph taken July 31 from a hill overlooking cotton line and acid area. Nitrating house for cotton line B in foreground, acid tanks and nitric acid concentrator at the left, poacher and blending houses for lines A and B in center

Making Explosives For World War II

JULES BEBIE

Consulting Chemical Engineer and Professor of Chemical Engineering, Washington University, St. Louis, Mo.

***Chem. & Met.* INTERPRETATION**

It has been estimated that the United States will soon be producing explosives at the rate of three million lb. per day. This figure represents the total for all types. Prof. Bebie in his article tells what these types are and what America is doing to assure an adequate supply of each. The discussion of the various explosives in the different groups includes physical and chemical characteristics which determine suitability for various applications. —*Editors.*

UNTIL quite recently we had only a small standing army and a proportionately small plant capacity for the production of military explosives. The tremendous extension of all of our armed forces, provided for by the National Defense program, called for an equally far-reaching program for the manufacture of explosives and ammunition. At the end of World War I we had an explosives industry of similar proportions, capable of producing millions of pounds of explosives daily. However, under the influence of the general demand for disarmament during the post-war period, the plants were dismantled and now the job had to be done over again at a cost of at least 400 million dollars. Before discussing the munition program and its execution, it might be helpful to review briefly the field of military explosives.

Hundreds of explosives are known but comparatively few can comply with the many rigid requirements specified for military uses. Entirely different explosive properties are needed for different uses.

Abstracted from an address presented at the National Defense Meeting of the American Society of Mechanical Engineers, St. Louis, Mo., Sept. 9, 1941.

FOUR TYPES OF EXPLOSIVES

Primary explosives are characterized by their great sensitiveness to heat, shock or friction and they are used to initiate the explosion of the main charge of either propellant or high explosives. Mercury fulminate and lead azide are important representatives of this group.

The propellants have a comparatively slow rate of burning and the pressure is built up progressively. Formerly black powder was used for this purpose; today smokeless powder with a nitrocellulose base is the one propellant used the world over.

Bursting or high explosives have a very high rate of detonation, 2,000-9,000 m. per sec.; they have a high brisance or shattering power and are therefore used as bursting charge for shells, bombs, mines and torpedoes. The high explosive most generally used is trinitrotoluene, TNT, because it is stable, can be loaded in liquid form and gives a very satisfactory fragmentation. TNT is only slightly sensitive to shock and is not easy to detonate by means of primary explosives.

Boosters are sensitive high explosives. Less sensitive than initiators, they are used in the explosive train between the initiator and the bursting charge to facilitate the detonation of the latter. Tetryl is the most important representative of the booster type of explosives.

PRODUCTION

Detonators or primary explosives are used in comparatively small quantities. No mass production and no serious equipment problems are involved, but we must keep in mind that the manufacture is hazardous. Extreme caution must be exercised. Mercury fulminate is the most sensitive explosive in our service, and its manufacture is comparatively simple. A shortage of mercury would be a possibility if mercury fulminate was our only available initiator. In more recent years however, it has been partly replaced by other primary explosives such as lead azide, lead styphnate, dinol and nitromannite. Moreover in small arms ammunition, the trend is to use detonators with chlorate and perchlorate explosives as a base, in place of mercury fulminate.

With the manufacture of smokeless powder we are getting into the field of mass production. The original defense program provided for a

daily production of about one and one-half million pounds. The service powder of our army and navy is now a straight nitrocellulose powder and this is called a single base powder. In some European countries double base powders are used. The British "Cordite" for instance is a mixture of nitrocellulose and nitroglycerine. Both types have certain advantages and disadvantages. A double base powder containing nitroglycerine is somewhat more powerful than a single base powder but is also more corrosive. In the former the strength can be regulated to some extent by means of nitrogen content. The theoretical maximum nitrogen content for nitrocellulose is 14.1 percent. The highest military nitrocellulose contains about 13.3 percent and is called gun cotton; the common smokeless powder has 12.6 percent nitrogen and such a product is called "pyro" or "pyro-cotton." At present, IMR or improved military rifle powder is being used, which is a mixture of the other two mentioned grades containing about 13.1 percent nitrogen.

POWDER PLANTS

The largest plant for producing nitrocellulose and smokeless powder at Charlestown, Ind., installed at a cost of 51 million dollars and operated by the Du Pont Co., takes care of daily production of 600,000 lb. of smokeless powder. The Radford plant, W. Va., installed at a cost of 25 million dollars is being operated by the Hercules Powder Co., and is expected to produce 300,000 lb. of smokeless powder per day. This plant would have been in operation three months earlier if it had not been for delay in the delivery of electrical machinery because of strikes.

The powder produced in these plants is a single base powder. However, small amounts of modifying agents are incorporated. About 1 percent of diphenylamine is added as a stabilizer; other compounds such as DNT (dinitrotoluene, hydrocellulose, nitroguanidine, and powdered metals are used as deterrents or for the purpose of reducing flash and hydroscopicity in the manufacture of NH (nonhygroscopic) and FNH (flashless-nonhygroscopic) powders. Finally, a graphite coating is applied to promote ease in pouring grains and to prevent the collection of electrostatic charges.

Manufacture of high explosives also involves very extensive plant equipment. The outstanding project in this field is the manufacture of TNT.

Plants under construction and practically completed within the National Defense program are located in Wilmington, Ill., Weldon Springs, Mo.,† and Sandusky, Ohio, and provide for a total daily production of 775,000 lb. of TNT and 130,000 lb. of DNT. A possible bottleneck in TNT manufacture is the availability of toluene. The chief source of supply is the light oil of coal tar, limited to the amount of coke production. Fortunately processes have been developed in recent years to produce toluene from petroleum hydrocarbons. A number of crude oil producers have been installing equipment for this purpose. Production from this source has already doubled our normal supply from light oils. The method is capable of rather fast expansion and the potential production is tremendous.‡

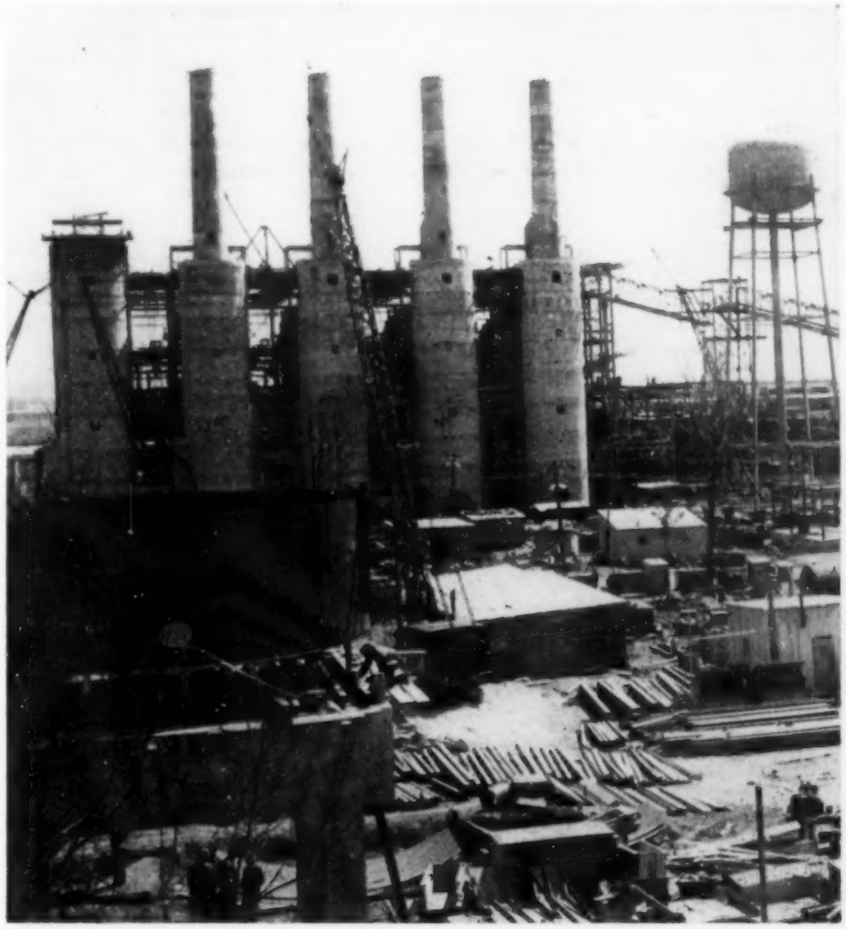
In World War I picric acid was also one of the chief explosives used as a shell filler. Like TNT it is comparatively insensitive to shock. It has, however, acidic properties; it can form metal picrates with the metals of the shell and these are very sensitive and may cause premature explosion of the shell in the gun. For this reason shells loaded with picric acid have to be coated on the inside with lacquer or a synthetic resin. Another disadvantage is that its melting point is too high for loading in the molten state. This difficulty can be overcome by addition of other nitrocompounds such as dinitrophenol, which will lower the melting point.* Ammonium picrate (explosive D) is one of the least sensitive high explosives, less sensitive than TNT, and is therefore generally used as a base charge for armor piercing shells. A plant costing 10 million dollars is being built in Arkansas for producing explosive D.

† The War Department announced on Sept. 30 that the Weldon Springs Ordnance Works started operations on Sept. 29, less than 10 months after engineers began their topographic survey of the area.—Editor.

‡ The Baytown Ordnance Works at Baytown, Texas, has been completed and turned over to the Army for operation. This plant, erected and equipped at a cost of $12,671,477 will manufacture toluene from petroleum hydrocarbons.—Editor.

* Picric acid may still be considered important as a reserve explosive.

Taken several months ago, this view in the acid area of the Indiana Ordnance Works at Charlestown, Ind., shows construction of one of the power houses



Another very useful high explosive is ammonium nitrate. It is extremely insensitive to shock and therefore not suitable for use by itself. However, having an oxygen excess it is very effective in combination with nitro high explosives which have an oxygen deficiency. For this reason it was used extensively in World War I in combination with TNT. Mixtures of ammonium nitrate and TNT are called amatol. A 50-50 mixture is about as effective as straight TNT and can be loaded in the same manner. This is of great significance. Should we ever have a temporary shortage of toluene, we could stretch the available supplies by mixing it half and half with ammonium nitrate. The plant at Muscle Shoals, Alabama which was ready for operation in the World War I for manufacturing ammonium nitrate is being overhauled and extended. New plants for the synthetic production of ammonia have been installed at West Henderson, Ky. and Morgantown W. Va. which will add another 100,000 tons to our present production of 300,000 tons of nitrogen. Some more recent and more powerful high explosives are produced for special purposes, for instance Penthrite, as a base charge for antiaircraft and antitank ammunition.

As intermediate detonators or boosters, several of the more sensitive high explosives have been used, such as TNA (tetranitroaniline), hexyl (hexanitrodiphenylamine), and tetryl (trinitrophenylmethylnitramine). The latter product is the one being favored in the munition program. The explosives plant in Wilmington, Ill. has a capacity for a daily tetryl production of 30,000 lb. There are two processes in use for tetryl manufacture, one by means of nitration of dimethylaniline, the other using nitrochlorbenzene and methylamine as raw materials and nitrating the resulting reaction product. The latter method is cheaper and apparently more generally satisfactory.

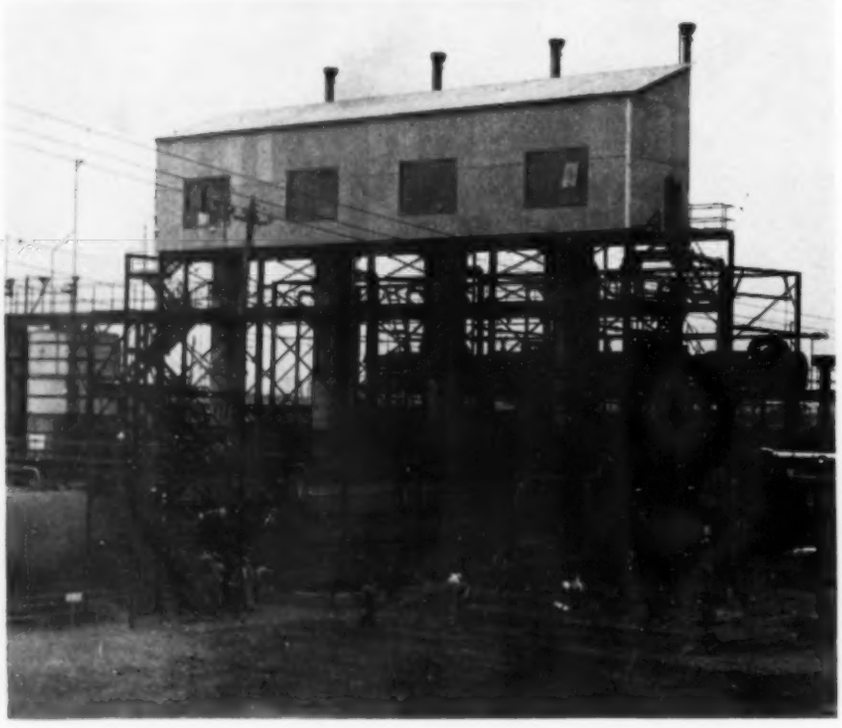
BLACK POWDER

The old black powder, a mixture of potassium nitrate, charcoal and sulphur, still has several military uses: In the manufacture of primers and fuses; as ignition charge for smokeless powder in separate loading ammunition; as base charge or expelling charge for shrapnel shell.

A special branch of the explosives industry covers the field of pyrotechnics. Magnesium, strontium salts, barium salts, phosphorus, thermite, etc. are used for flares, for signaling and for incendiary purposes.

It is estimated that in the near future we will produce daily 3 million lb. of explosives of all kinds. The assembling of this material into all sorts of ammunition and ordnance is another project of tremendous magnitude. It comprises loading primers, fuses, small arms ammunition, shells, bombs, "fixed" and "separate loading" artillery ammunition. As a result of the splendid cooperative efforts of the Ordnance Department arsenals and private industries these projects are also within reach of satisfactory completion.

Ammonia oxidation plant at the Kankakee Ordnance Works, Joliet, Ill. The plant is located in the south acid area and this view shows construction as of Aug. 28



SUMMARY

Comparing the present situation with 1914–1918, relative to manufacture of explosives, we are in a much better position today.

Nitric acid which is needed in the manufacture of all explosives is now being produced from the nitrogen of the air and we are no longer entirely dependent on Chile nitrate which was formerly used.

Toluene, the basic raw material for the manufacture of TNT, is now obtained in large quantities from the petroleum industry.

Manufacture of explosives is a branch of the organic chemical industry requiring much technical skill, knowledge and experience. In 1914 our synthetic organic chemical industry was in its infancy. Meanwhile it has developed marvelously and is today in a state of perfection and efficiency second to none.

Operation of the new explosives and ammunition plants will require specifically trained technical personnel for supervision and inspection and for chemical, physical and ballistic testing. It is estimated that at least 6,000 such men will be needed and suitable training has been planned long in advance by the U. S. Bureau of Education in cooperation with universities and engineering societies, and is being carried out effectively in Engineers' Defense Training Courses which are offered at engineering schools throughout the country.

The national defense program for manufacture of explosives and ammunition has been most thoroughly planned and efficiently executed. All of our new plants are either operating or will be in operation in the near future. No very serious bottlenecks in raw materials exist within the present program. The plants are operated under highly skilled and experienced management and we can feel confident that all of our armed forces will be adequately supplied with any required munitions.

A Small Plant's Defense Against Accidents

J. T. MORRIS *Superintendent*

Franco-American Chemical Works, Carlstadt, N. J.

Chem. & Met. INTERPRETATION

An enviable safety record has been established by a comparatively small New Jersey plant while processing dangerously flammable materials. Their success is due largely to the efforts of a "safety committee" which meets monthly to consider and to act on employee suggestions and weekly plant inspection reports. The result is "good housekeeping" which makes for safe operation. — *Editors.*

WITH HEADLINES focusing attention on speed-up of plant expansion, production and research in the present national emergency, management is particularly interested in preventing any occurrence that would break stride with the common cause. In the light of recent reports on life and property losses in the field of chemical industry and discounting whispers of sabotage, safety of operation continues to offer the best remedy for our troubles. To eliminate so-called accidents, it is first necessary to recognize their two main causes—faulty human behavior and poor environment. This requires a somewhat non-technical approach, in that it takes teamwork, coupled with skill, to combat the ever-present danger of corrosive and flammable materials in chemical manufacturing.

Considering our own good fortune with the human hazards involved in safely processing millions of gallons of volatile esters, solvents, nitrocellulose solutions, and the like, we feel that much credit is due our friendly and cooperative employee relations. Most of this can be attributed to our policy of job continuity, which assures a thorough intimacy between work and worker. In support of this, our records show the average tenure of service for each person is over ten years. Therefore, a considerable portion of safety expense lies hidden in payroll and reappears as an asset later in general operating efficiency.

Here follows a resume of a campaign of care, which to date, accounts for an accident free record of over 4,200 hours per employee. Though aware this mark has been surpassed by others in the field, investigation reveals that prevailing injury rates for alcohol and solvent manufacturing as a group are 9.44 in frequency and 0.23 in severity for each 2,000 man hours worked. This is accentuated by the latest report of the Travelers Insurance Co., in which they developed a rate of 7.93 frequency and 1.23 severity for the chemical industry as a whole, while all other industries averaged 12.18 and 1.53 per 2,000 hours.

It is true our total falls considerably short of the aggregate man hours credited to larger corporations, but there is satisfaction in the knowledge that not many can equal our exposure rate per individual. This is not said to disparage the severity and frequency of accident occurrence in plants with large staffs, but only calls for recognition of the industries' smaller units in the matter of safety effort.

To cope intelligently with calamity, it is necessary to go further than supply protective equipment. Thus, it is obvious that organization is needed to delegate authority and guidance in safe housekeeping. For the small manufacturer, a safety committee is best suited for the responsibility of safety furnishings. At Franco-American such a committee of department heads representing 15 percent of total personnel, holds a monthly luncheon to hear current suggestions and review weekly plant inspection reports. A check through the files of this group for the past eight years reveals an unbroken chain of weekly reports and monthly meeting records, showing an average of 62 employee suggestions complied with yearly.

As evidence of the program's constancy, our company has participated in the yearly New Jersey Statewide Interplant Safety Contests to win eight certificates for perfect records consecutively since 1933. Concisely, the interests of management and labor in injury escape are alike and their interdependence must be recognized. An active safety committee requires voluntary assistance from key men to sell the idea.

Our attempts in prevention are varied, particular care being taken in handling flammables through the use of grounds for static electricity, beryllium copper tools, explosion-proof wiring and lighting, plus a rigid daily cleaning schedule. Routine cleaning includes freeing apparatus of deposits which, upon ignition, will spread fires to adjacent operating equipment. As an example of the hazards in these accumulations, recently our rubbish pile broke into flame when scrap glass tubes with convex ends concentrated the sun's rays upon lacquer waste.

Although half of all fires start from causes unknown, defective electric wiring and spontaneous combustion are frequent offenders. Last summer, while painting the office, a workman, after rubbing down the woodwork with linseed oil, deposited the saturated cloth upon a window sill during lunch hour, later to discover the same a glowing mass from spontanous ignition.

Because of the many corrosive substances encountered in everyday maintenance, we supply a protective hand cream to combat cutaneous irritants.

Several years ago we purchased electric lanterns for the use of local train crews when shifting freight cars within the year at night. This precaution was prompted by observing a brakeman leave his lighted kerosene lantern beneath an acetone storage tank. Another step in our safety program was the removal of all overhead high voltage power lines, restringing them over unoccupied property to a transformer house and thence into three underground circuits.

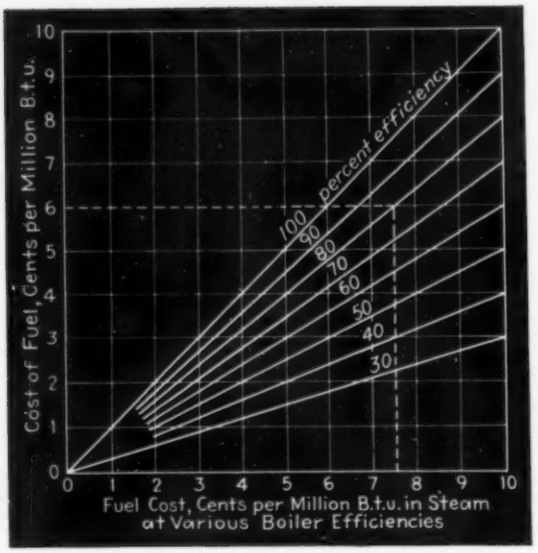
Normally, accident prevention is industry's first line of defense, but at the present production tempo, it becomes an outpost of national importance.

Thus, it appears there will be an increasing need for good listeners in supervisory capacities. Attentive ears, as well as sharp eyes, will spot impending trouble well in advance of carelessness.

Steps to Steam and Power Profits

DAVID MOFFAT MYERS

Consulting Engineer, New York, N. Y.



Economical fuel choice must take into consideration the efficiency with which its heat can be put into steam in the boiler

A YEAR AGO, one of our clients invested under our supervision $135,000 in steam and power improvement. The returns the first year were $35,000, at which rate their investment will be liquidated in less than four years.

Another client invested $180,000 three years ago. He reports $70,000 a year gain in reduced cost of steam and power which means this entire improvement has now returned the original investment, and a handsome profit for future years continues as dividends.

A small plant owner invested $30,000 five years ago. In three years his money was returned in operating savings and in the last two years he has received $20,000 as profits over and above his returned investment.

Other specialists in the field of industrial power could quote many similar examples of investment results but for convenience I have taken these three instances from my own personal experience. I could continue examples like these for pages, many of them more striking in their quick return. But these are enough for the present purpose.

What do such examples prove? They most certainly do not prove that every other plant owner can go and do likewise. They do prove that where conditions are favorable, where a plant is old, out of balance, economically inefficient, then and then only, good engineering can offer investment for profit on a most lucrative basis.

There are hundreds of such plants in existence. In a large percentage of these enormous waste continues simply because management is unaware and ignorant of the possibilities for profit. This is true chiefly in the medium to small sized industrial units on whose payroll quite naturally there is no one of sufficient technical ability in this highly specialized field to make the necessary analysis and report.

The same wastefulness exists in many of the larger plants for another reason. The management in these is usually fairly well informed on the conditions and possibilities. But the emphasis is placed on pushing sales and improving production. There is, however, a consideration generally not recognized which if given its proper weight might alter managerial decisions.

In excellent business years power, light and heat have cost industry in this country an amount equal to 60 per cent of its distributed earnings. In poor years this expense has equalled or exceeded such earnings.

The present tax situation drastically reduces net earnings, so that today industries' bill for power, light and heat may easily equal dividends. In such an individual case, a saving in the cost of power and heat services of 20 percent would increase the dividends by a like percentage. Such an accomplishment would be highly gratifying both to management and stockholders. Orders for new business are not nearly so profitable to stockholders as stopping waste and excess cost in the power supply. Each dollar saved in the latter is a whole dollar, whereas each dollar of new business results in probably not over 10 cents in profits.

Opportunities for such power profits are very prevalent in our manufacturing plants where the annual cost of power, light and heat can be reduced from 10 to 50 per cent depending upon prevailing conditions.

We have heard much lately of packaged units for power, complete and ready to press the button; and they are excellent in certain kinds of small, specialized jobs where they belong, but a very costly misfit and wasted investment where they do not belong.

In the same way there is no packaged prescription for the cure of a factory's power and heat supply.

For example, the most efficient design of high pressure steam power

***Chem. & Met.* INTERPRETATION**

Every dollar saved by increased plant efficiency, as the author points out, is a whole dollar, whereas each dollar of new business can rarely amount to more than 10 cents in profits. This is one of the factors, sometimes lost sight of, which emphasizes the need for extreme care in insuring that a process industry's power and process steam facilities are the best possible choice for its particular conditions. This choice is often not a simple one to make. Fallacious ideas often creep in. Power problems cannot be solved by rule and expert analysis is the only solution.—*Editors.*

plant, of central station type, perfect in every detail from air preheaters to condensers, would be an utter failure and dead loss is a manufacturing plant which required a large volume of steam for process purposes. This modern power plant would produce a kilowatt-hour for a minimum cost, but its combined cost of steam and electricity would be out of all bounds.

I know of one nationally famous industrial establishment where this exact thing occurred. The results were so costly that the new power plant had to be abandoned and the management was forced to resume operation of the old outmoded plant which at least did make use of some of its exhaust steam.

Highly efficient power units do not always pay dividends. A certain plant owner did not believe this, so he replaced an old engine with one that would require 25 per cent less steam for the same power. But the fuel consumption in his plant was unchanged by this "improvement." The reason was simple. All the exhaust of the old unit was used for process heating. The lesser exhaust from the new engine necessitated drawing live steam from the boilers in equivalent amount to make up the deficiency. Total steam and fuel were not reduced.

Another manufacturer thought efficient equipment was the whole story so he installed new and efficient boilers with excellent pulverized coal equipment, to supply manufacturing steam at 110 lb. pressure. The boilers were designed for 160 lb. Then he asked us to study the problem of making his own electric power which he was then buying. We found that if he had bought his boilers for 250 lb. design pressure at a slight extra cost his entire power supply could have been generated as a by-product of his process steam, and at a cost of 3 mills per kilowatt-hour instead of the 1.15 cents he was paying for purchased power. But this nice big saving or profit was not feasible under the circumstances, all because the owner had believed that if he purchased efficient equipment he would fully serve the interests of economy.

Another efficiency mistake is frequently made by managements when they buy a piece of apparatus which actually saves them money. That statement may seem paradoxical. But the explanation will make it clear. A steam driven electric generator unit of a certain type is purchased under a guarantee of saving, and it does make this saving. So far, so good. Shortly after, a consultant is called upon to make a study and report on the whole steam and power situation, and finds that very substantial annual sums can be saved if purchased power is adopted and no energy is generated on the property. Such findings render the cost of the guaranteed power unit of no value and a capital investment has been wasted. In other words, while the efficient unit saved money, the same funds expended in another direction would have saved several times as much annually.

Electric drive for factory equipment is ideal from the standpoint of operating convenience and presents a long list of well recognized advantages. It is looked upon by manage-

100 Possibilities for Power Plant Improvement

This list, taken from the author's McGraw-Hill book on "Reducing Industrial Power Costs," is, as he explains, by no means exhaustive, but represents merely the result of half-an-hour's listing of obvious possibilities. The solutions must, of course, be adapted to the particular case.—*Editors.*

1. Change of fuel.
2. Firing method.
3. Recording system.
4. Bonus system.
5. Elimination of scale.
6. Elimination of soot and dust.
7. Elimination of air leaks.
8. Change to stokers.
9. Reduce carbon loss in ash.
10. Change to pulverized coal.
11. Change to purchase of steam.
12. Eliminate short circuiting of gases.
13. Combustion-control system.
14. Flue-gas analysis.
15. Insulation.
16. Air preheating.
17. Economizers.
18. Storage of hot water at night.
19. Equalizing load on boilers.
20. Reducing number of boilers.
21. Change of steam pressure.
22. Superheating steam.
23. Change of type of grates.
24. Change size of grate surface.
25. Change draft system.
26. Improve flue connections.
27. Shift load from inefficient to efficient boilers already installed.
28. Install better boilers.
29. Coal handling.
30. Ash handling.
31. Draft-gage use.
32. Repair reduction by improvement.
33. Feed-water regulation.
34. Feed-water heating.
35. Feed-water aeration.
36. Return of hot drips.
37. Elimination of oil from system.
38. Heat recovery from cont. blowdown.
39. Waste-fuel utilization.
40. Economical coal storage.
41. Coal-purchasing system.
42. Stop and check blow-off leakage.
43. Stop steam-pipe leakage.
44. Improve steam traps.
45. Reducing-valves where full pressure not needed.
46. Separate moisture from steam.
47. Cheaper water supply.
48. More efficient feed pumps.
49. Eliminate unnecessary steam piping.
50. Stop compressed-air waste and leakage.
51. More economical air compressors.
52. Reduce back pressure.
53. Utilize engine exhaust.
54. Overhaul engines and pumps to reduce leakage and steam use.
55. Overhaul turbines for blade and nozzle erosion.
56. Operate condensing where exhaust not needed.
57. Improve vacuum on condenser.
58. Improve efficiency of cooling of circulating water.
59. Replace old engines with uniflow or corliss to equalize exhaust to needs.
60. Operate engines or turbines to replace purchased power if conditions favorable.
61. Change schedule of power units, load division to save steam.
62. Utilize warm condenser water for process.
63. Reclaimers for hot-water heat recovery.
64. Variable vacuum system for heat utilization.
65. Exhaust heating from receiver between high-pressure and low-pressure cylinders of compound engines.
66. Improve steam-valve setting of engines.
67. Turbines—straight condensing.
68. Turbines—back-pressure type.
69. Turbines — bleeder-type — condensing.
70. Turbines—bleeding several stages—noncondensing.
71. Stagger heavy power loads for better efficiency.
72. Scientific lubricating methods.
73. Where all electric power purchased, operate steam-air compressors steam pumps or fan engines for heating load.
74. Scientific control of steam heating of buildings, especially where direct steam is used.
75. Vacuum return system for building and other heating.
76. Diesel oil engines.
77. Combination of oil engines and steam engines for heat balance.
78. Buy all power.
79. Make all power.
80. Make part, buy balance.
81. Purchase steam supply.
82. Departmental measurement of steam, water and electricity to check waste.
83. If purchased current, reduce bill by reducing demand.
84. If purchased current, reduce bill by increasing power factor.
85. If purchased current, reduce bill by increasing load factor.
86. If purchased current, reduce bill by changing to another schedule.
87. If purchased current, negotiate better contract.
88. Re-motor to reduce consumption and improve power factor—correct motor sizes.
89. Reduce friction of drives with antifriction bearings, individual machine drives, etc.
90. Improve efficiency of water-pumping system and reduce waste of water.
91. Prevent short-circuiting of circulating water.
92. Sufficiency of power for production.
93. Sufficiency of steam for process.
94. Management personnel.
95. Breakdown service vs. reserve units.
96. Conversion direct current to alternating current and vice versa.
97. Waste-heat boilers, air heaters or economizers for process heat recovery.
98. Interconnect neighboring plants.
99. Redesign of combustion chamber such as raising setting height, adding combustion arch, curtain walls, etc.
100. Develop own water power.

ment generally as highly efficient. The loss of energy between the prime mover (engine or turbine) and the driven shaft of the machine is of the order of 30 percent and may be greater. Thus with a generator efficiency of 93 percent and an average motor efficiency of 75.3, the combined efficiency is 70 percent with, a loss of 30 percent without figuring the line loss.

The loss in a well laid-out shaft and belt mill drive is frequently no greater and sometimes less at full load. At partial loads the electric drive gains in advantage. However, in spite of the modern adoption of electric drive, there are numerous drives which should be the old-fashioned direct or belted steam engine for highest overall economy with which variable speed also is readily obtained. In these selected cases the loss between engine and driven shaft may be 5 percent or less, against the electric drive loss of 30 per cent. Furthermore, when the exhaust is usable the economy of the combination cannot be improved.

The diesel engine unit naturally takes popular fancy. It is highly efficient for the generation of power, since it converts one-third or more of the heat of its fuel into useful energy. But when its fuel costs over twice that used by other prime movers for the same heat content it is clear that "efficiency" is only one factor in economy.

Another case: The mercury binary cycle of boiler and turbine combined with a steam turbine has produced kilowatt-hours over a six months' period for the lowest consumption of B.t.u.'s on record. It has slightly exceeded all previous efficiency attainments. But its cost is prohibitive for industrial use.

So it is clear that the plant owner cannot go into the equipment market and buy power apparatus simply because it is efficient, with any guarantee that his total cost of heat and power will be reduced.

Many times the economic solution is the purchase of outside power. Frequently a combination of generated and purchased power produces the lowest overall cost. Even when all power should be and is purchased, waste still commonly continues due to low power and load factors which, with the adoption of proper measures, could be prevented. When the purchase of electric energy is the right answer the generation and use of steam may remain uneconomical unless this end of the expense account is properly engineered.

One of the first things to be determined in the study of an industrial power situation is the relation or ratio of steam requirements to power demand. Thus, if 100,000 lb. of steam per hour is required for manufacturing and process purposes and the corresponding demand for power is 2,000 kw., the ratio is 50 to 1.

EFFECT OF RATIO

Now, if the temperature for process is such as to require say 100 lb. steam pressure, then a turbine generator supplied with 400 lb. initial pressure, with proper superheat, will generate the required 2,000 kw. at a 50 lb. water rate. The process steam of 100,000 lb. per hour at 100 lb. pressure is now supplied as exhaust from the turbine.

To put it another way, the 2,000 kw. is a byproduct of the process steam. About 6 per cent of heat is added to the 100 lb. steam when it is raised to 400 lb., which percentage is extracted by the turbine, thus leaving the factory steam in the same condition. The modern boilers installed would generally be at least 10 percent more efficient than the old ones, so that the 2,000 kw. would become somewhat better than a pure byproduct of the process steam.

If the ratio of steam demand to power demand were 100 to 1 then only about 220 lb. boiler pressure would be needed for the turbine generator.

The factory which requires much steam compared to electric requirements has a high ratio which is favorable to byproduct power. The necessary steam boiler pressure is lowered as this ratio increases and as process steam pressure or back pressure is reduced.

The second example of economy quoted at the beginning of this article was an improvement of this nature in which the turbine generator made byproduct power from 165 lb. process steam.

This method of profit making has been widely applied during the last 12 years, but would be a failure unless conditions were favorable. If for instance the steam demand does not sufficiently synchronize with the power demand throughout the working periods then the profit of the plan may not warrant the cost.

Even when an industrial power problem is properly worked out in the most economical manner as to fuel, equipment, correct heat balance and coordination of all elements, the cost of operation may be far away from the attainable minimum.

I have seen many good plants running at 10 to 30 percent above normal annual costs because of inefficient operation and here is golden opportunity for profit.

The overall efficiency obtainable with any combination of men and machinery is the efficiency of the men times the efficiency of the machines. Expressed another way, Efficiency $= E \times H$ in which E equals the equipment efficiency and H the Human Factor efficiency.

The final correct solution of a given industrial power problem for the production of profit may be quite a simple one as to equipment, design and operation.

But the *determination* of that correct solution is another matter. Enough examples have been given to show that there is no packaged unit and no standardized plant that can be applied with profit to all situations. It will have now become clear that each situation demands an individual solution based upon the peculiar conditions and requirements of its case.

The first step is an investigation to ascertain whether your plant is one of the many in which a handsome profit awaits capture. If the answer is "No," then you may congratulate yourself in the knowledge that you have an economical power and heat supply.

The second step, if the answer has been "Yes," is to secure a correct prescription or set of recommendations which, when properly executed, will produce the maximum of profit for the minimum of investment.

This is a simple program as far as executive decision is concerned, with the exception of a single item which is involved to such an extent that success or failure depends completely upon it.

This single item is the selection of the engineer to whom this program is to be entrusted. In large corporations, if they are operated with a centralized engineering staff, there is usually sufficiently specialized talent available for the undertaking.

In other corporations of equal size, where management is localized, it is not usual to find within the organization men competent to make a really authoritative analysis and report. So many other duties are imposed upon the staff that they are unable to devote much of their lives to the study of steam and power, and the management also may deem it to be less expensive to retain outsiders occasionally than to continue

(*Please turn to page 85*)

Stratification of Gases in Kilns and Dryers

EDWARD LEDOUX *Civil Engineer, Latrobe, Pa.*

Chem. & Met. INTERPRETATION

The author has recently completed a several months' study of the problem of obtaining proper distribution of heat in convection-heated equipment such as kilns and dryers. This work led to a study of the stratification of gases in such equipment, which is prerequisite to an understanding of distribution. Since the subject is one which concerns heat processing equipment of many kinds, Mr. Ledoux has consented to summarize the results of the study in two articles, the first of which appears here. As a starting point the subject is approached from the standpoint of a natural-draft tunnel dryer, with the simplifying assumptions that the flow of hot air is frictionless, and the dryer is empty. The laws of heat distribution are then determined under a number of conditions. The concluding article will demonstrate the effect of hot air friction, a loaded dryer, and forced draft, and will discuss the influence of dryer design and operation on performance.—*Editors.*

Among the most important requirements in industrial heating operations are uniformity of temperature or the controlled distribution of the heat to the material undergoing treatment. These factors are paramount in the successful operation of such widely diversified plant equipment as chemical product furnaces, tunnel and periodic dryers, kilns, metallurgical furnaces and recuperators, etc. It may be said that this applies to every sort of heat-processing equipment in which the heat is transferred by convection, whether by forced or natural draft, or a combination of the two. In such operations stratification of the heating gases is often one of the principal reasons, if not the chief reason, why actual results fall short of expectations based on the original design calculations which assumed uniform distribution.

Stratification of the type caused by gravity is the separation of substances into layers according to their respective densities. For instance, since the density of hot air is lower than that of cold air, the former will tend to settle above the latter.

However, this condition is not one of static equilibrium in the case of gases because it is opposed by their ability to diffuse. Furthermore, in the case where the density difference is caused by temperature, stratification will also be opposed by the transfer of heat from the hot layer to the cold. Stratification cannot occur spontaneously or be maintained in an airtight, insulated space and a necessary condition for its existence is the continuous renewal of the gases at a greater rate than the rate of diffusion. In certain cases, differences in static pressure at the same plane will accelerate the disappearance of stratification.

For the purpose of illustrating the mechanism of stratification, the case of industrial drying has been taken in the following discussion. However, the same considerations apply to other heat treatment installations.

NATURAL DRAFT

To begin with, let us consider a dryer operating solely on the natural draft created by a steam heater located as shown in Fig. 1*a*, the cross section of the stack being half that of the dryer and the hot air inlet being equal to the stack opening. (In practice it is smaller.) We will at first assume the dryer to be empty and that there is no temperature variation, no friction loss and no diffusion. The last named condition means that, for the moment, we will consider that the hot air of density d does not mix with the cold air at density D any more than water mixes with air in hydraulics.

Before steam is admitted to the heating coils, the dryer and stack contain nothing but cold air at density D. When the heat is turned on, the hot air at density d will rise to the ceiling. There it will spread down the dryer as more hot air is produced by the heater until, having reached the end of the dryer, it will fill the stack, provided that the cross section of the latter is properly proportioned to the flow. At that moment the operating natural draft will be established and the cross section of the hot stream will equal the stack opening.

This state of affairs, represented in Fig. 1*a*, is characterized by: (1) a rising column of hot air above the heater; (2) a stratum of hot air traveling at the ceiling; and (3) a volume of trapped cold air under the hot air layer.

In Fig. 1*b* is shown the pressure diagram along path $IJKL$ (see Fig. 1*a*) at the moment when the operating draft is established. If atmospheric pressure is p at the top of the stack it is equal to $p + HD$, or $p + h'D + hD$, or $p + (h' + h)D$, at ground level and this is the total pressure immediately below the heater coils; immediately above, the total pressure is that of the inside hot air at that plane, i.e., $p + Hd$, or $p + h'd + hd$, or $p + (h' + h)d$, which is lower. In these expressions, p is atmospheric pressure at the top of the stack, H is the total height of the stack top above the ground, D and d are respectively the densities of cold and hot air, h' is the height of the stack top above the lower level of the hot stratum, h is the height of

the lower level of the hot stratum above the ground, and $H = h' + h$. The total pressure difference across the heater coils is what produces the air flow through the dryer and, if the system is frictionless as assumed in this first article, the outlet velocity created by this difference is given by the expression:

$$(p + HD) - (p + Hd) = \frac{dV^2}{2g}$$

or $V = [(2g/d)\ H\ (D - d)]^{\frac{1}{2}}$

Here V is velocity, g is the acceleration of gravity, 32.2, and the expression $dV^2/2g$ is the velocity pressure of the hot air stream at the stack outlet, represented graphically in Fig. 1*a* by the line *CD*. For frictionless flow the outlet velocity pressure is equal to the total pressure difference. The cross section of the stratum and that of the rising hot air column being the same as that of the stack, their velocity pressures are the same and $AB = EF = GH = CD$.

In the stack the static pressure of the hot air becomes higher, owing to gravity, as lower levels are considered. In dropping from the top of the stack to the stratum lower limit, the increase is $h'd$, represented by the sloping line *HD* (which rises at point *H* an amount equal to $h'd$). Thus the static pressure at the stratum lower limit is $p + h'd$, as represented by the horizontal line *FH*. Similarly, in the rising hot air column, the static pressure is also greater at lower levels on account of gravity, increasing by an amount hd in dropping from the stratum lower level to the grille level. Therefore, at the ground level the static pressure of the hot air column is $p + h'd + hd$, or $p + (h' + h)\ d$, or $p + Hd$.

Now, the static pressure at the lower limit of the stratum being $p + h'd$, the static pressure in the cold air at ground level will be greater by an amount equal to the weight of cold air below the stratum, that is hD, which is graphically represented in Fig. 1*b* by the dashed horizontal line from *B'*, drawn with the slope *B'F* equal to slope *D*.

The static pressure variation with altitude inside the dryer is also shown on Fig. 1*a*, by the broken line *MNP*, referred to the abscissa *QSR*. Here $QM = h''d$, $SN = h'd$ and $RP = h'd + hD$.

If the dryer is airtight, the cold air, which in this case is practically stationary, cannot remain in the dryer and stratification must disappear; in other words, the thickness of the hot air layer must grow until it fills the entire cross section of the dryer. The mechanism is as follows: At ground level the cold air, which as was shown is at a higher pressure, will flow into the hot air stream and be entrained. This will cause a vacuum effect on the volume of cold air so that its pressure will decrease and the static pressure variation line *NP* will shift to the left and become *N'P'* (Fig. 1*a*). Then, at altitude *h*, the pressure of the hot air (which is $p + h'd = p + SN$) will be greater than the $p + SN'$ of the cold air, so that the hot air will move downwards as far as point *T* which corresponds to a new equilibrium. This process will continue until all the cold air has been evacuated. Then the thickness of the hot stratum will be equal to the height of the dryer, point *T* having reached point *O*. This final condition is shown on Fig. 1*c* where $GH' = GH/4$. This follows from the fact that, since the velocity in the dryer is half that in the stack, the velocity pressure is divided by 2^2.

It will be noticed that the elimination of cold air becomes more and more rapid since the static pressure of the stratum, and therefore of the cold air at ground level, increases gradually.

We have supposed thus far, for simplicity of discussion, that the size of the inlet grille is equal to that of the stack. When it is smaller, which is the normal practice, the velocity pressure of the hot column is greater and its static pressure lower than in the previously considered case. Hence the evacuation pressure difference is greater and the elimination of the cold air more rapid.

EFFECT OF LEAKAGE

If there is leakage into the dryer, for example, under the doors, stratification will persist because the mass of cold air will be continuously renewed. It will be seen by referring to Fig. 1*a* that at ground level at the ware inlet door, the outside pressure $p + (h' + h)D$, or $p + h'D + hD$, is greater than the inside pressure $p + h'd + hD$ by the amount $h'(D - d)$, which will cause the outside air to rush in. This air will be carried away by the column of hot air at the other end through the mechanism already described, thus creating a countercurrent of cold air on the floor of the dryer. At the ware outlet door, outside air will rush directly into the column of hot air if, as in Fig. 1*a*, the grille is at the door. For the same leakage aperture the inrush here will be greater than at the other end because the pressure difference, $(h' + h)\ (D - d)$, is greater.

It will be seen that in the case of leakage, two opposing effects are in action—the evacuation of cold air at point *I*, which increases the depth of the hot stratum, and the continuous supply from the outside which limits this increase. When these

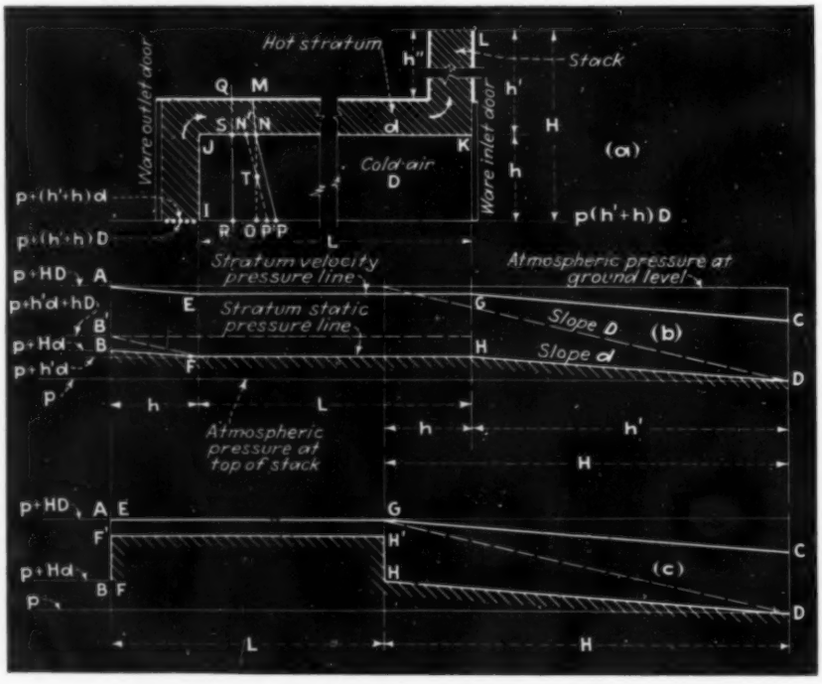


Fig. 1—Graphic analysis of static and velocity pressures in a theoretical (frictionless) dryer: (a) dryer cross section; (b) pressure diagram at moment of establishing draft; (c) pressure diagram with cold stratum eliminated

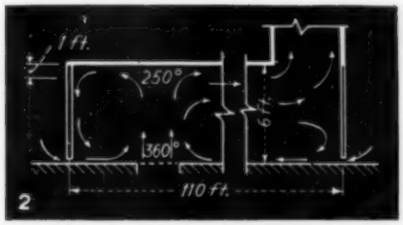
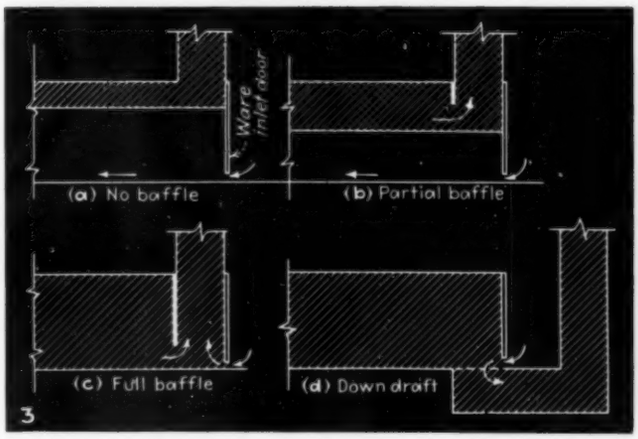
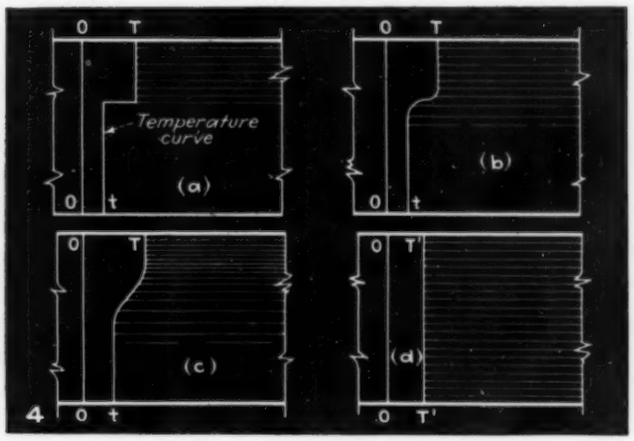


Fig. 2—Observed air movements in a dryer with leaky doors; note temperature drop in hot column

Fig. 3—Effect of baffling and downdrafting on stratification in a dryer with leaky doors; baffling is effective but inconvenient

Fig. 4—Effect of diffusion on temperature variation with height in a dryer: (a) no diffusion, extremely high velocity, low temperature difference; (b) little diffusion, high velocity, medium temperature difference; (c) much diffusion, low velocity, high temperature difference; (d) total diffusion, no velocity





two effects are equal, equilibrium is reached and the stratum assumes a definite depth. The smaller the leakage and the cold countercurrent, the more nearly will the dryer be filled with hot air.

The sketch Fig. 2 shows the movement of air observed in an industrial dryer with leaky doors. The considerable temperature drop in the hot column caused by the cold air taken up is quite significant.

It may be remarked that air leakage is not only detrimental in lowering the temperature of the hot air stream, but also in cutting down the draft by so doing.

The opening of doors will produce a similar effect inasmuch as a large mass of outside air is pushed in each time. At the ware inlet end the inrush is so considerable that some cold air will be mechanically entrained directly up the stack and a disturbance of the flow in the stack will be observed. Upon subsequent closing of the doors, suction of the hot column at point *I* (Fig. 1*a*) must evacuate the quantity thus admitted until equilibrium is reached anew (i.e., complete uniformity in temperature if the doors are tight or the minimum stratification obtainable if the dryer is not airtight.)

When unavoidable stratification occurs due to leakage, the depth of the hot stratum can be increased by means of a baffle at the foot of the stack, as shown in Fig. 3. This baffle, acting as a weir, will back up the hot air before it can flow over and out. With full baffling as in Fig. 3*c*, the hot zone can be brought down to the floor and the cold inrush at the wave inlet end will be evacuated directly to the stack.

Unfortunately, baffling will interfere with the passage of the ware, but downdraft evacuation as shown on Fig. 3*d* will serve the same purpose as full baffling. In this case the cold air coming from the outside falls directly into the grille and thence to the stack. The drawback of downdraft evacuation is a greater heat and friction loss.

EFFECT OF DIFFUSION

In the previous discussion, we have made an abstraction of diffusion and only considered the effect of static pressure differences in the mixing of hot and cold air. In reality, all gases will diffuse into each other, both of them tending to occupy the entire available space. This will occur regardless of the fact that the heavier gas may be initially below the lighter one. In such a case, however, diffusion, which is a slow process anyway, will be even slower because the phenomenon must proceed against gravity.

Owing to diffusion the separation between hot and cold air will not actually be a distinct horizontal plane. Instead of an abrupt temperature change, there will really be a continuous variation. However, since diffusion takes much time, if the velocity of the hot air is appreciable only a limited diffusion will have time to occur, particularly if the cold floor current is high.

To show schematically the temperature variation with elevation inside the dryer, according to the amount of diffusion, Fig. 4 is presented. The extreme case, where there is no diffusion (Fig. 4*a*), would be that of very high velocities of the countercurrents, and a low stratum temperature. The opposite extreme case (total diffusion, as in Fig. 4*d*) would be that of an airtight volume initially containing a stationary stratum of hot air. Even in this case completion of diffusion takes considerable time.

STEAM AND POWER

(Continued from page 82)

specialists on the payroll when their services are needed infrequently.

In medium and small sized industrial plants, mistakes are made most frequently since in these the permanent employment of staff members who are power and steam specialists is naturally out of the question. Their mistakes are of two kinds. The first is the result of doing nothing. The second is from taking unsound or prejudiced advice.

Any industrial steam and power situation which has not been properly checked for the last 20 years generally presents attractive possibilities for profits. There have been very important advances in practice and in available equipment in that period. Furthermore, by the end of such a term the depreciation fund should be ready for purposes of profitable investment.

Preference Ratings Are UP TO YOU

WILLIAM B. SPOONER, JR. *Industrial Consultant, Spooner & Kriegel, New York, N. Y.*

Chem. & Met. INTERPRETATION

Do you understand the priorities system? Know how to expedite the securing of scarce materials? Think it's "just a lot of red tape," to be side-stepped if you can get the needed materials without it? Difficulties can result all along the line of supply in an important order when a single manufacturer "breaks the chain" of rating certificates or orders that normally should be used to avoid delay. But perhaps you feel your output doesn't figure importantly enough in defense to rate a high preference. Are you sure? Or you may believe that priorities are on their way out, to be replaced shortly by allocations and that on that account you should stop trying to track down all the high ratings you are justified in getting. Even if true, high ratings will help establish your right to generous allocations. So, prove your case, then proceed as our author tells how. —*Editors.*

YOU NEED a new vacuum pump or filter. Perhaps you need butyl alcohol, zinc chromate, trichlorethylene or caustic soda. Gaskets are wanted for certain pumps. A mill needs relining.

You issue suitable purchase orders and very shortly thereafter get responses from each of the supplying companies involved informing you that, much as they appreciate your business, they will be unable to give you any definite delivery date unless you can furnish them with some kind of definite preference rating. Where the supplier has been through the priorities mill many times, he will probably clarify his position by pointing out that he needs this rating for the purpose of getting needed metals, raw materials or supplies to fill your order, and cannot get them unless you provide the kind of preference rating which will assist *his* suppliers to fill *his* orders.

DESTINATION: DEFENSE

As a manufacturer of chemicals and related products, you know that a preponderance of your products eventually find their way into first line defense projects. You know that if products like yours were not available, there would be little use in ordering munitions, tanks, planes, guns, searchlights, uniforms or practically anything needed for national defense. But because of the devious paths most of your products take in reaching defense usage, you are not able to make definite estimates, much less specific analyses as to the percentage actually used in defense work. By the same token, you yourself have relatively little direct evidence of the importance of your products in the picture to enable you to get a preference rating yourself.

It is true, of course, that you may have direct government orders for some of your products. You may be building or operating a plant which produces certain scarce materials which warrant and get a preference rating order from the Office of Production Management, just as an Army or Navy order warrants and gets a preference rating which you utilize on preference rating certificates. In either case you use these authorizations to get equipment, materials or supplies you need in connection with your production for such orders or projects.

You know how to handle such preference ratings. But, except for comparatively rare instances, they cover only a part of your total production. You need equipment, supplies and materials for this production also. You know that in the long run most of it is essential for defense or for the smooth functioning of the defense program. How do you go about getting preference ratings to apply to such production?

This is *your* responsibility. Your supplier cannot help you. Provision of an adequately high preference rating must come from the persistent efforts you make to get it.

Let's take a look at this whole question and examine the machinery set up to provide these ratings, with the purpose of defining the steps you should take to get as many high preference ratings as possible. Please note that the discussion which follows makes no pretension to being a guide to procedure in filling out forms. It does not cover the approach you should make in stating your case, although this is often of vital importance. Much detail is omitted here, including the steps you should take when a preference rating has been issued to you and does not get you the supplies you need. These and all other details involved in the actual use of the forms discussed here should be taken up with the office of the Office of Production Management in your locality.

The fundamental purpose of these pages is to point out the vital need for careful selection of the path or paths you use in getting preference ratings. This story indicates why this search for high ratings will help you get more quickly the equipment, supplies and materials you need, and establish the importance of your products in the defense picture. It shows also how this search will aid materially in the progress of the program itself.

PREFERENCE RATINGS

What is a preference rating? Note, first of all, that there is a common system of these ratings, which applies to all phases of the priority picture. They constitute a grading of the place of any needs for materials, supplies and equipment in

the order of their importance to the progress of the defense plan as a whole. They function essentially in two ways. In every case a preference rating presented to you by a customer on the proper form is not only an authorization for you to supply the material called for in the order of preference indicated by the rating. It is also a mandatory order to you to supply the material in this manner. You must accept the order whether you like it or not. Similarly preference ratings passed on by you to *your* suppliers are mandatory.

Note, however, that a high preference rating does not necessarily mean that you must stop work on all other production which involves a lower rating, or even that which has no rating. It does mean that production and/or delivery must be planned so that the delivery date or dates involved in the case of the higher orders must be met. When delays are involved in order to insure delivery dates on orders with ratings, the lower ratings must be the ones affected.

A preference rating may also be used as authority for your suppliers to produce and/or deliver the things you need to produce the materials covered by the rating. In many cases a preference rating can be extended from the original order to which it applies, down the line in turn to each supplier whose products are necessary to the completion of the original order.

Preference ratings range from AA down to A-10 for orders on defense activities (which include many nominally non-defense activities closely affecting the progress of the defense program) and from B-1 to B-8 for the majority of civilian and non-defense needs.

RATING CLASSIFICATION

AA ratings are always reserved for orders of the utmost urgency and for future emergencies. The highest regular rating is A-1-a, followed by A-1-b, A-1-c, and so on, down to A-1-j. Next come A-1, A-2, A-3 and so on, down to A-10, the lowest of the A group. So far no alphabetical sub-divisions have been made in the A-2 to A-10 ratings, though this is a possible future development.

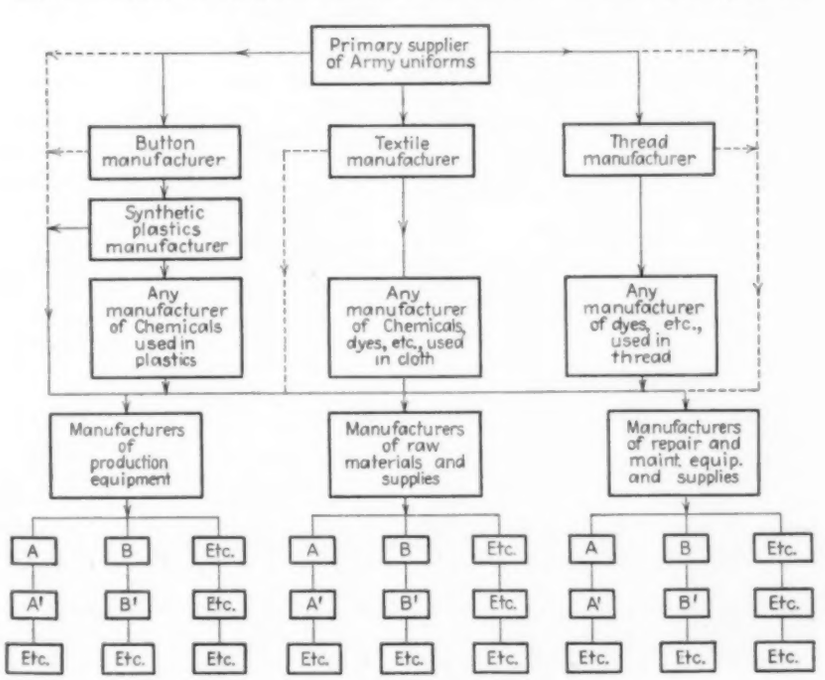
Obviously you get preference ratings as a result of your applications which reflect the judgment of the OPM or of a government contracting agency as to the importance of the products concerned in the defense program. An A-1-a or A-1-b rating puts you at the head of the line together with other firms having a similar rating. An A-9 or A-10 rating puts you down at the end of the defense activities line, together with many more holders of the same range of ratings. It is obvious that the higher the ratings are, the greater is the selectivity and the fewer the number of firms having the same ratings and needing the same things. The lower ratings naturally tend to collect many more holders (particularly the A-10 rating), which tends to hold all borderline and dubious cases which cannot quite be pushed over into the B group of ratings.

These B ratings should not be regarded as worthless. Covering non-defense needs as they do in most cases, they are, of course, not always able to insure supplies of very scarce materials, or of equipment which involves the use of such materials. If the best rating your efforts yield you is a B rating, make full use of the facilities it provides. Note that the machinery for utilizing these B ratings is similar to that discussed here for A ratings. If you fail to obtain needed supplies under a B rating, consult with your local OPM office and let them advise you what steps to take.

In any event, you should persist in efforts to track down preference ratings originally issued on defense projects or activities, and which should have been extended to you if your products ultimately are needed by such activities or projects. In this way you will in many cases obtain not only an A rating, but a relatively high A rating.

Note that a low A rating is not necessarily to be despised. Remember that the preference rating system involves not only relative importance, but relative delivery dates. There are A ratings in the lower brackets, put in that category because the required delivery dates for the material involved are some time ahead. Again, if any A rating does not produce materials needed at the time they are needed, consult your local OPM office for advice.

Indicative of the complex flow of orders resulting from a single type of primary government order (such as for army uniforms) is this chart which traces through only the main transactions related directly to chemicals. Solid lines show the flow of these orders while dashed lines indicate the orders of other types of manufacturers (not shown in detail) for equipment, materials and maintenance and repair equipment



FORM PD-1

Form PD-1 may be regarded as the grand-daddy of the priority forms. It was set up and is still used for the purpose of presenting your case for needed equipment, materials and supplies to the Office of Production Management. It is used to permit them to study the facts—particularly your statements as to the importance of your products in defense work—and select a preference rating which will put your needs in the proper place in the waiting line when considered from the overall defense viewpoint, with due consideration of the national

economy as whole, and the importance of the delivery dates involved to the entire program. When you fill out Form PD-1, you list specifically the things you need, the quantities involved and the supplier or suppliers from whom you expect to get them. You also submit, in Paragraph 10 of Form PD-1 or in an accompanying letter, your own picture of the place of your products in the defense program or in the national economy, along with any data which will help your case. Even if you are certain that your products are not in any way connected with defense, or that their defense uses are negligibly low, you have the right to show their importance in the maintenance of public health, in civilian needs and in the carrying on of non-defense industrial operations. A place in the line waiting for scarce materials is important, even if it is way down at the end. But make your story as brief as possible.

Form PD-1 goes to the OPM Priorities Division in Washington. There it is studied and a preference rating is assigned to your requirements. Note that it is advisable to make out a separate PD-1 form for each class of supplies you need. Where all kinds of materials are included on one form, the application must be routed through many committees, thus leading to much delay. Individual groups go immediately to the proper committee and much quicker action results.

PD-1 PROCEDURE

Your filled out form, when it has been acted upon, is authenticated by the OPM and the preference rating assigned is noted on the form and its copies. You get this form back and then serve it on your supplier. This authenticated form going to your supplier is his authority to fill your order in accordance with its place in the picture established by the assigned preference rating. But if he, in turn, needs materials from some other source to fill your order, he cannot extend this authenticated PD-1 form to his supplier or suppliers. He must, in his turn, make out a fresh PD-1 form, in which his case and your needs are presented. This procedure must be followed as many times as are necessary, until a final supplier is reached who can deliver the needed materials without going to another supplier.

Hence Form PD-1 is not always satisfactory for your purposes. It has the advantage of being available to all, whether engaged on defense work or not. It can and often does provide high ratings. On the whole, however, because of the common difficulty in establishing close relationship to defense work, ratings tend to be lower in the scale. Above all, the delays involved in repeated re-use of the form, where needed materials come from a series of suppliers, are not necessary if you are entitled to extensions of high ratings applying to your products. These extensions (of either preference rating certificates or orders) come from your customers who, in turn, may have to get them from *their* customers.

PREFERENCE RATING CERTIFICATES

If you have a direct order from the Army and Navy; from one of a number of Government Departments, or from Great Britain or any other foreign government under the Lend-Lease category, you usually do not have to apply for a preference rating. Instead, the contracting officer or agency supplies a preference rating with your order—usually high up on the scale. When you have a preference rating from such sources, you have achieved the easiest and quickest path to getting what you need. All you have to do is to fill out Form PD-3 (for Army or Navy orders); PD-4 (for other Federal Government orders), or Form PD-5 (for certain foreign government orders: i.e. the British Empire and the government of any other country whose defense the President deems vital to the defense of the United States). Then a smooth, rapidly functioning machine is set in motion. Note that PD-3 forms are not made freely available, and can be used only if your product is required in the production of Army or Navy work. Note once again that evidence of such use will come to you in the form of an extension of Form PD-3 from your customer and in turn from *his* customer, up to the point where the primary contractor holding the original preference rating is reached.

EXTENDING PD-3

When you fill out one of these forms, and have it signed by the proper authenticating office of the defense activity concerned, your supplier, if he needs materials to fill your requirements, simply fills out another PD-3, PD-4 or PD-5 form, addressed to his supplier, has it authenticated by the most conveniently located office of the defense activity involved in his locality, and sends it on to his supplier. This process can be speedily repeated until the final supplier is reached who can ship the needed materials without reference to any other supplier below him in the chain.

If by some oversight you have not been supplied with a preference rating, though working on a direct Government contract, you can easily get it by applying to the contract officer or agency or to the OPM in Washington.

Note that once *any* company has been assigned a preference rating for a contract as a result of direct government orders, there should be set in motion a chain of PD-3, 4 or 5 forms which should reach down rapidly to every company concerned with supplies of any kind which go into the production of that order. It is the failure of essential links in this chain to materialize which explains why you do not get as many high priorities as you should—and at the same time, indicates a cure for the situation. This subject will be discussed in detail later.

For the present, remember that these three forms, PD-3, PD-4 and PD-5, are the only extendable preference rating certificates (though blanket preference rating orders discussed in the next paragraph are also extendable). These forms should interest you greatly since they offer the most direct and most desirable means of getting needed supplies, all the way down the line from the original order for tanks, planes, searchlights *or any other defense needs,* to the maker of the smallest item of supplies or equipment which goes into the filling of the order.

PREFERENCE RATING ORDERS

Just as effective as the preference rating certificates, are the preference rating orders, often called "limited blanket rating orders." They are obtained from the OPM and are not issued by contracting officers or agencies of the Army, Navy or other Government departments. They are obtained as a result of application on suitable forms to the OPM for preference ratings, either because the OPM has issued a blanket priority set-up for certain types of manufacturers, or because the specific things produced have a vital part in the defense program and are recognized as such by the OPM. For example, you may decide to erect a plant for the production of chlorine, vinyl plastics, or any one of the many materials which are vitally essential to

Choice of Procedure on Preference Ratings

For	First Choice	Second Choice
Equipment (Filters, stills and process equipment generally.)	Preference rating certificates or orders extended to you by your customers and *their* customers.	Form PD-1
Production Materials (Chemicals, raw materials, production supplies generally.)	Form PD-25 (Defense Supplies Rating Plan) **Or** Preference rating certificates or orders (involving large amounts of material on a specific defense project) which have been extended to you.	Form PD-1
Repair or Emergency Inventory Materials (Parts, equipment, accessories, assemblies, etc.)	Use of certification authorized by Preference rating order P-22.	None
Other Maintenance and Repair Supplies	Form PD-1 **Or** Preference rating certificates or orders involving maintenance or repair items on defense activities.	None

the defense effort. Whether or not you have laid such plans with the approval or knowledge of the Government, you will ordinarily have no difficulty in getting a preference rating order from the OPM to enable you to get the equipment, materials and supplies you will need for such a plant.

ORDERS VS. CERTIFICATES

Preference rating orders are similar to preference rating certificates in that they are usually closely related to defense activities and obtain ready recognition in the form of high preference ratings for that reason. They differ from the certificates in that they are not extended by such forms as PD-3, PD-4 or PD-5, but by the simple procedure of making a copy of the order itself, properly executing it, and passing it on from supplier to supplier. Like the certificates, they can be extended indefinitely. The original project or defense activity, be it a chemical plant or a power dam, receives a preference rating in a preference rating order. The equipment needed is ordered with an accompanying copy of the preference rating order. The equipment maker can utilize this preference rating in getting his supplies by sending a copy in turn with his orders, and so on down the line. Each of these orders varies somewhat and it is necessary to read each one in order to know how to extend the rating or to operate under its terms.

It is reasonably safe to assume that, if you are in a position to ask for such an order, you already know this to be so and have taken steps to get it. But as in the case of the preference rating certificates, these orders are supposed to initiate an unbroken chain from the prime contractor down to the ultimate supplier who can supply needed materials without needing a preference rating, because he has stocks on hand, or can get them from *his* supplier without a rating. If at any point in the chain a supplier does not ask his customer for an extension of either certificate or order, to pass on to his supplier (or if the holder of such an order or certificate does not pass it on), all the remaining organizations below the supplier in the chain are unable to identify themselves with the original defense project. This not only works extensive hardship on all these subsidiary suppliers, but tends to defeat the whole purpose of the priorities system. Hence it is highly important that you make every effort to reinstitute that broken chain by tracing through your customers (and insisting that they trace through *their* customers, and so on) the ultimate source of all your orders, until you or they finally unearth the preference rating certificate or preference rating order which has become lost through this break in the chain. Note, however, that you are not supposed to use a preference rating if you can get the material without it.

BLANKET PRIORITIES

A number of preference rating orders are available to certain divisions of the chemical industry by reason of blanket priority recognition given to them by the OPM. For example, makers of anaesthesia supplies, biologicals, antitoxins and serums, medicinal chemicals and other health supplies can ask for an A-10 preference rating (in the form of a preference rating order) by filling out Form PD-79. You should keep in close touch with developments in order to avail yourself of such blanket priority situations which exist, or which may be instituted in the future.

The Defense Supplies Rating Plan and the maintenance and repair preference rating discussed below are also implemented by means of preference rating orders.

DEFENSE SUPPLIES RATING PLAN

There is another possible path to preference ratings which should not be overlooked. It has been thoroughly recognized by the OPM that the ordinary procedure in getting priorities will not insure effective and economical plant operation in many cases, so some plan had to be set up to enable plants to order necessary supplies of working stocks over reasonably long periods. The difficulty of ordering many supplies on a piecemeal basis is another factor. The Defense Supplies Rating Plan is the answer.

Under this plan, any manufacturer (practically speaking, though the plan originally applied only to certain selected industries) can use Form PD-25 to ask for a preference rating of A-10 which applies to orders for materials three months in advance, although defense orders are not as yet received, but only to be expected on the basis of, and in the proportion to, past experience. At the end of this period the rating must be renewed, but during the time it is in force, the form possessing this rating (which is issued in the form of a preference rating order) can order and obtain that percentage of its total requirements in scarce materials and supplies which, as established by the percentage of total sales over a definite period, is concerned with defense.

You are probably already familiar with the statement or certificate forms PD-25C revised and PD-25D which have been widely used by your suppliers (and probably by your own sales department) on which, in default of preference rating certificates or orders, a customer can provide a definite estimate as to what part of the material or equipment he produces is used in defense. These forms have no value to the supplier in obtaining the things he needs to fill these orders, except to build up a picture for his own use in applying for a preference rating on Form PD-25 (under the Defense Supplies Rating Plan), or on Form PD-1. If you use PD-25, you use the data from the affidavit forms, as well as all preference rating orders and certificates received, to arrive at your calculation of what percent of *your* total sales volume constitutes defense work. There is a space on the form for you to list your present stocks of scarce materials and your require-

ments of these materials for *all* of your production for the next three months. After analysis and review, the OPM will give you an A-10 preference for the scarce materials you need, based on the percentage of your past sales that were concerned with defense.

For example, if your calculation as approved shows that for the period you analyze, 87½ percent of your sales was for defense, the preference rating order you finally get (on Form P-6) will authorize purchases of 87½ percent of the quantities of scarce supplies you have specified in your application. Of course all such supplies must be used on defense work and if there are any surpluses at the end of the three-month period, they must be credited against your needs for the next three months for defense purposes. On the other hand, if you underestimate needs, you will be allowed to apply for and will get a suitably increased volume.

The Defense Supplies Rating Plan has one weakness—an A-10 rating, which is not always 100 percent effective. In the majority of cases, however, it works very well. You will not be able to use it for capital equipment, though it would apply to scarce supplies and materials and stock units. Remember, even if *you* do not use this plan, *your suppliers* need the data you can furnish them on Forms PD-25C Revised and PD-25D, to enable them to apply under this plan (on Form PD-25) for supplies and materials they need to fill some of your orders. Cooperate with them by answering their requests for these filled-in forms.

MAINTENANCE AND REPAIR PRIORITY

Among other selected industries, the chemical industry is privileged to utilize a special preference rating (A-10) on material and parts required to carry on repairs needed to meet an imminent or actual breakdown, or to maintain an emergency inventory to provide for repairs to meet an actual imminent breakdown.

This is covered by a blanket preference rating order P-22. It differs materially from most other preference rating orders, in that no copies of the original order are required for its extension, and no application for the order itself is necessary by any chemical plant. If you need parts or materials for repair, all you have to do is to put the following statement on your order to your supplier and see that it is countersigned by a responsible official of your company: "Purchase Order for Repair or Emergency Inventory—Preference Rating A-10 under Preference Rating Order P-22."

Your supplier, if he needs materials to fill your order, simply puts a corresponding statement on his order to *his* supplier, without reference to your specific requirements or to your company. The supplier's statement follows: "Purchase Order for Material required to fill a duly rated order for Repair or Emergency Inventory. This purchase order bears Preference Rating A-10 under Preference Rating Order P-22."

There has been too much table thumping, pleading and dependence on friendship in the situation in the past. These things worked because the pinch had not been felt greatly and the temptation was great to serve old customers or to get a foot in the door in places hitherto hard to sell. But from now on, in the face of specific shortages felt on all sides, these tactics will not work, however human the motives may be that prompt them.

Do not blandly assume that it is up to your suppliers to get preference ratings for you. The shoe is on the other foot. That's your job. Don't delay doing it.

If you have any preference rating certificates or orders, whether received directly from a Government contracting agency or the OPM, or indirectly through any of your customers, be sure to extend them to all your suppliers with every order you issue for supplies, material and equipment to be used on orders to which they apply. Do not wait for them to ask for extensions. Even though a supplier does not ask for an extension, remember that somewhere down the line there will be a company which wants to identify itself actively in the defense effort, but will be unable to do so unless you maintain the links in the chain by extending all ratings you have.

You may be and probably are a sufferer in this respect yourself and have no preference ratings on a great part of your production, although you know that by far the greatest part of it ultimately finds its way into primary defense work. Don't congratulate yourself on being able to avoid a lot of priority paper work if you are temporarily getting along all right without ratings on this production. You should have specific evidence of the part this portion of your sales volume plays in defense to insure supplies. And you, in turn, should play fair with suppliers below you in the chain who need these ratings, even if you think you don't.

Here is a point worthy of very close consideration: Chemical and process equipment of practically every kind is rarely used so that it is always working on non-defense items. It might be used so little for defense work that only 5 percent of the output of a unit is actually used eventually for defense. But—and this is important—if this unit is absolutely essential for the production of that 5 percent, it must be considered as 100 percent essential for defense. You cannot apportion equipment as you do raw materials.

Hence from the equipment viewpoint, in particular, every high preference rating you can unearth in connection with your products has a bearing on your ability to get needed equipment.

GETTING HIGH RATINGS

How to unearth these high ratings? Go to your customers. If they have no preference ratings applying to those of their products which require supplies from you—see that *they* take the next step. Insist that they ask their customers for ratings and, if need be, that they ask their customers to continue this search for ratings until, somewhere along the line, a preference rating is met.

Then, by extension of orders or certificates, depending on the form of the rating, the process is reversed and in a reasonably short time you will get a rating in a form to extend in turn to your suppliers. This seems a slow process and it is. But it works! For example, only the other day we heard of a typical case. A manufacturer of equipment received and passed on for needed steel a mighty attractive A-1-a preference rating from a chemical company. Yet this firm had insisted, until the unearthing process was explained and sold to them, that they had no ratings—had no way of identifying themselves with defense, and were not particularly interested in going through the trouble involved in searching for a rating. *Now* they will get the equipment they need and do a worthwhile bit on defense which might otherwise have been impossible.

What alternatives have you? Your work is intrinsically important to defense, but you are not ordinarily in a position to get high ratings in spite of this fact because of the nature of your products and their uses. If you depend entirely on the ratings you can get, where pref-

erence rating orders or certificates do not reach you automatically from your customers and *their* customers, you will not be benefitting by many higher ratings which you deserve when you have identified any of your products in any volume with defense activities. Low ratings, not necessarily handicaps, may nevertheless delay important defense work, which is unfortunate when this identification would have been possible except for failure to pass on to you higher ratings on orders or certificates from primary suppliers of defense materials.

If you are determined to hunt down such high ratings as are in existence, often unknown to you because somewhere above you in the chain some firm has not asked for or extended a preference rating, you will find yourself with more and more high ratings, for rapid and effective use in getting supplies, materials and *particularly* equipment on practically all of your total production volume.

Remember that no one wants to fill out any more forms than he has to. If a holder of an A-1-a preference rating finds he can get any one thing he needs without executing and passing on a PD-3 form, he will not do it. The supplier who neglects to demand such a form, even where he can just manage to supply needed material without any buying from *his* suppliers, is doing the whole defense program serious injury, because he has broken the chain which will enable all the other suppliers below him to identify themselves with highly essential defense work. After all, when such a firm does break the chain, it is depleting supplies of needed items which will have to be replaced for future needs along the same lines, so that the essential purpose of the plan is defeated anyway. Of course one of the primary objectives of the defense program is to keep inventories low and turning over as rapidly as possible. You must bear in mind that you must avoid excessive stocks.

YOU MUST DO IT

Preference ratings are up to *you*, whether you like it or not. Go after them, no matter how much you dislike the job. Forget the old ideas of not annoying customers. Remember that customers are sellers as well as buyers and need the same kind of information you do today for the same reasons. Without adequate ratings the day will come, not many moons ahead, when your production will suffer and your place in the picture will be too low for comfort.

SUMMARY

You get the following types of ratings chiefly from your customers as extensions to you (usually from their customers). You may also get them directly from Government contracting officers or agencies, and from the OPM:

Preference Rating Certificates or Preference Rating Orders—These ratings tend to be in the highest brackets. They are particularly desirable in getting speedy delivery of equipment. It is true that Form PD-1 is widely used for asking for preference ratings on equipment, but where equipment is needed to supply materials called for by defense needs, it is entitled to the rating available on preference rating certificates PD-3, PD-4 or PD-5 or on preference rating orders involving General Preference Order P-19. Such certificates or orders should also be sought for in connection with comparatively large quantities of supplies or raw materials where lower ratings would mean delays in filling orders.

You get the following types of ratings chiefly by application to the OPM, though many are also passed on by customers:

By Use of Form PD-1—Here you apply for a rating on scarce and needed materials, supplies or equipment, subject to delays, particularly where your supplier has to obtain supplies to fill your order. In general, this form should be used chiefly to get a preference rating on that part of your production which is definitely non-defense or concerned with civilian needs or public health in classifications not otherwise provided for in existing OPM orders. It works very well in cases where you are sure that your supplier will not need to go to anyone else to fill your needs.

By Use of Form PD-25—This form is used in connection with the Defense Supplies Rating Plan, leading to a rating of A-10 which allows you to order scarce materials for a three-month period. It must be renewed thereafter for subsequent three-month periods. It should be used in almost every case where you need stocks of raw materials, supplies and intermediates which cannot be ordered practicably on a piece-meal basis, or which are required in stock quantities for efficient and economical production. It is not intended for obtaining process equipment, although it is most useful in ordering motors or similar accessory units required for stock purposes.

By Acting Under Preference Rating Order P-22—This is the repair and emergency inventory rating, which enables you to apply an A-10 rating to materials and parts required to insure efficient operation and to avoid breakdowns.

By Use of Forms Applicable to Specific Industrial Groups—Your particular division of the chemical and process industries may be entitled to a preference rating order, carrying a rating of A-10, because the OPM has designated certain products (which may form a worthwhile proportion of your production) as capable of getting this rating. Whether or not you use this approach will depend on your success in getting higher preference ratings by other methods.

Research Expenditures at Peak This Year

According to a recent announcement by Robert L. Lund, chairman of the committee on patents and research of the National Association of Manufacturers, an unprecedented total of $117,490,000 will have been spent during 1941 by manufacturing industries throughout the United States. His report covered expenditures for the development of new products by a representative group of manufacturers in every classification of manufacturing industries of the country.

The report which was given by Mr. Lund was based on a study conducted by Dr. Carl T. Compton, president of Massachusetts Institute of Technology, and chairman of the association's research advisory committee. In the table below the research expenditures and their relations to gross sales are listed for 14 groups of industries:

Industry	Research expenditures (X 1,000)	Percent of sales
Food products	3,886	0.2
Textiles and products	1,786	0.5
Forest products	1,300	0.4
Printing & publishing	1,208	0.6
Chemicals	30,695	2.4
Petroleum and coal products	3,868	0.5
Rubber products	1,919	1.0
Leather	231	0.2
Stone, clay and glass	1,074	0.8
Iron and steel, excluding machinery	8,024	0.5
Non-ferrous metals	2,963	0.7
Machinery, excluding transportation	45,474	3.0
Transportation equip	10,259	2.0
Miscellaneous and unclassified	4,803	0.6
Total, all industries	117,490	1.1

Chem & Met PLANT NOTEBOOK

Timesaving Ideas for Engineers

OUTLINE OF A NINE-POINT PROGRAM FOR DESIGN OF MULTI-COMPONENT FRACTIONATING SYSTEMS

SCOTT CROSLEY *Chemical Engineer, New York*

SEVERAL simple methods have been proposed whereby it is possible to approximate the design of a multi-component fractionating system.[1, 2, 3] Most of these are based on the separation of two appropriately selected key components. However, it can be shown by plate-to-plate computations that these simplifications have definite limitations, and that three conditions must be fulfilled for any degree of accuracy: (1) The separation of the key components should be a very simple one, that is, their boiling points should be substantially different. (2) The key components should comprise a large percentage of the total feed. (3) The temperature difference between tower top and bottom should not be great.

When these conditions cannot be met, it is unwise to rely on simple approximations. The only certain way to design a fractionating tower at present is by careful plate-to-plate computations, relying on approximations and operating data as expedient. A common procedure is outlined:

1. Set the tower operating pressure with two ideas definitely in mind: (*a*) The bubble point of the overhead product should be definitely above the cooling water temperature; (*b*) the boiling point of the bottoms should be substantially below the heating medium temperature. Many designers feel that the tower operating pressure should be selected so that the overhead condenser and the bottoms reboiler will cost the same.

2. Calculate the following equilibrium temperatures: (*a*) Dewpoint of the overhead product (tower top temperature); (*b*) bubble point of overhead product (reflux temperature); (*c*) bubble point of bottoms (reboiler temperature); (*d*) estimate the temperature rise through the reboiler from the boiling range of the bottom product; (*e*) determine feed conditions by an equilibrium, i.e., vaporization calculation.[4]

3. Determine the minimum number of decks required for the separation by the Fenske Equation.[5] Then double the figure obtained for the number of actual operating decks. This doubling is based on the theory that the theoretical decks will exceed the minimum decks by 50 percent, while 75 percent deck efficiency can be expected, i.e., minimum decks $\times$ 150/75 = actual decks. It should be pointed out that of all the simple approximations, the equation for minimum decks is the most dependable.

4. Determine the minimum reflux ratio by the Underwood Equations,[6] selecting the equation suitable for the feed conditions. Add 50 percent to this figure to arrive at an approximate operating reflux ratio. These equations are not as reliable as the one for minimum decks. Operators report many cases of towers which actually perform below minimum reflux conditions. In the majority of cases, however, these equations will give satisfactory results.

5. Compare the set-up arrived at with operating data or with plate-to-plate computations. In this connection it is well to watch the following details: (*a*) Operating pressure; (*b*) reflux ratio; (*c*) differential between top and bottom temperatures; (*d*) condition of feed, i.e., whether vaporized, at bubble point, or cold; (*e*) percentage of overhead products. Towers yielding small overheads often require large reflux ratios in order to provide sufficient revaporization in the reboiler; (*f*) tower size. It is well to make sure that the operating data are not for a tower operating in excess of capacity. Entrainment might be an important factor in such a case.

6. Make a heat balance around the tower using the temperatures and the reflux ratio previously determined.

7. Determine the maximum quantity of vapor entering the top deck by adding the induced reflux to the overhead product.

8. Determine the maximum quantity of vapor leaving the reboiler by means of the heat balance.

9. Determine the size of the tower by standard equations.[7] Allow sufficient additional area to offset that part of the tower which is occupied by the downcomers. Make a careful check to be certain that the tower will accommodate weirs sufficiently long to handle the maximum downflow without excessive running head. Often preliminary tower-size calculations will indicate different diameters for the stripping and exhausting sections. This condition may be altered by changing the condition of the feed in the following manner: (*a*) If the tower bottom appears to be the larger, increase the preheat; on the other hand, if the tower top controls, decrease the preheat, thus equalizing top and bottom.

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Sterilization of Air Supplied to Processing Departments Assured by Bactericidal Lamp Installation at Pharmaceutical Plant

First large-scale application of bactericidal ultraviolet radiation in an industrial plant was the installation of Westinghouse Sterilamps recently completed in the plant of Bristol-Meyers Co., at Hillside, N. J. The air passing through the ducts, at the rate of 40,000 cu. ft. per min., is rendered 95 percent free of airborne bacteria, according to reports. The installation includes 104 of the lamps, which are mounted vertically in a special chamber, spaced 1 ft. apart, in rows 15 in. apart. Each lamp operates at 475 volts and 0.04 amp. The 26 transformers used have an open circuit voltage of 3,000 volts and each supplies four lamps in series.

CHEM & MET REPORT ON

Opportunities in the Synthetic Organic Chemical Industry

TO CHEMICAL ENGINEERS AND PROSPECTIVE CHEMICAL ENGINEERS

It was with a two-fold purpose that this report on the synthetic organic chemical industry was prepared: to introduce the industry itself to all chemical engineers and, secondly, to help the prospective chemical engineer prepare himself for the profession of synthetic organic chemical engineering. The first section examines briefly the structure of the industry, its raw materials, products and its brilliant achievements in this country. Every chemical engineer should become more familiar with these phases of an industry which he, in particular, has helped to create. The second part deals largely with the opportunities and duties of the engineer in the synthetic organic chemical engineering field. Specific information, contributed by the industry itself, is given on employment and distribution of chemical engineers, trends and opportunities in various divisions, starting salaries, and qualifications most needed for success in the field.

CHEMICAL AND METALLURGICAL ENGINEERING
OCTOBER, 1941

Opportunities in the Synthetic Organic Chemical Industry

SUMMARY AND CONCLUSIONS

The synthetic organic chemical industry, young, confident and increasingly complex, draws attention because of the sheer magnitude and rate of its growth. With its largest division still having a total tonnage output less than that of soda ash alone, nevertheless its products are counted in the thousands and enter into most of the necessities and luxuries of life. With practically unlimited raw materials and with products and processes theoretically capable of almost indefinite expansion, it is only reasonable to predict that the industry, the most truly synthetic of all chemical industries, will continue to expand its markets and to develop new products for specific uses.

Technically-trained employees, including chemical engineers, have always played a major part in the development of the synthetic organic chemical industry. The complexity of many organic processes has created a real opportunity for chemical engineers to contribute their best knowledge and experience in the displacement of batch methods with continuous processes in order to improve yields and to lower handling and manufacturing costs of the product.

However, this same complexity of processing also demands the highest type of engineering talent. For those engineers with the proper training, ability and energy, it can be said that "synthetic organic chemical engineering is the engineering of the future."

The Organic Chemical Industry

Its Structure and Growth

YOUNGEST, fastest-growing and yet one of the most complex of all the chemical products industries, the synthetic organic chemical division is something of an enigma to many chemical engineers. This is partly because of its youthfulness, since the industry, now scarcely 25 years old, really began to assume major proportions even less than ten years ago. But this confusion probably originates even more from the complexity of its processing methods and the number and diversity of its products. Let us become more familiar with this industry.

SCOPE OF THE INDUSTRY

Before dealing with opportunities in the synthetic organic chemical field, it would perhaps be best to define the industry itself, to outline its divisions and scope, and finally to show the extent of its remarkable growth and present economic importance.

In 1923 the Synthetic Organic Chemical Manufacturers Association adopted the following definition:

> "A synthetic organic chemical is an organic chemical which has been produced by a controlled process involving change in chemical identity."

Although the two main groups of synthetic organic chemicals—aliphatic and aromatic—are capable of conversion into each other through chemical processes, industrial synthetic organics are, through usage, differentiated as those of either coal-tar or non-coal-tar origin. However, in this report we shall divide the industry into the following specific groups: (1) coal-tar derivatives; (2) petroleum and natural gas derivatives; and (3) miscellaneous origin (such as methanol synthesized from CO and H_2).

Versatility of Products—The actual number of commercial synthetic organic chemicals is seldom realized except by persons in the industry, and it is impressive to learn that the number of such compounds manufactured for further processing and/or sale in 1939 totalled approximately 2,475 as compared to about 1,450 in 1929. This growth is not due entirely to dyes, medicinals and other small tonnage groups, nor does it represent an increase in numbers alone. Table I shows the increase in number of products and tonnage of chemicals of non-coal-tar origin, which represent the largest division of the industry.

Aside from their wide use as dyes, medicinals, perfumes and flavors, and rubber accelerators and antioxidants, synthetic organic chemicals, especially those of non-coal-tar origin, are finding rapidly increasing applications as raw materials for synthetic resins, as solvents, refrigerants, detergents, antiknock and anti-freeze preparations, insecticides, flotation agents, photographic chemicals, war gases, tanning materials, dry cleaning fluids, synthetic rubbers, humectants, vitamins and as raw materials for other chemicals.

Diversity of Processes—Other than the orthodox methods of halogenation, nitration, oxidation, reduction, pyrolysis, and the like, there has arisen in recent years a host of important reactions made commercially economical by the use of catalysts. In fact, catalytic and high-pressure, high-temperature syntheses, both of which only began to be applied in earnest around 1925, now hold promise of important expansion in the future. Table II shows the number of certain catalytic reactions in organic chemistry. Probably 75 percent of

Table II—Catalytic Reactions in Organic Chemistry [1]

Approximate Numerical Rating	
Reduction	147
Oxidation	480
Hydrogenation	856
Dehydrogenation	200
Halogenation	164
Alkylation	69
Condensation	216
Polymerization	380
Isomerization	100

[1] Approximately as classified by catalysts and reactions. Bergman, Morrell, and Egloff, Catalysis, p. 682-1000, Reinhold Publishing Corp. (1940).

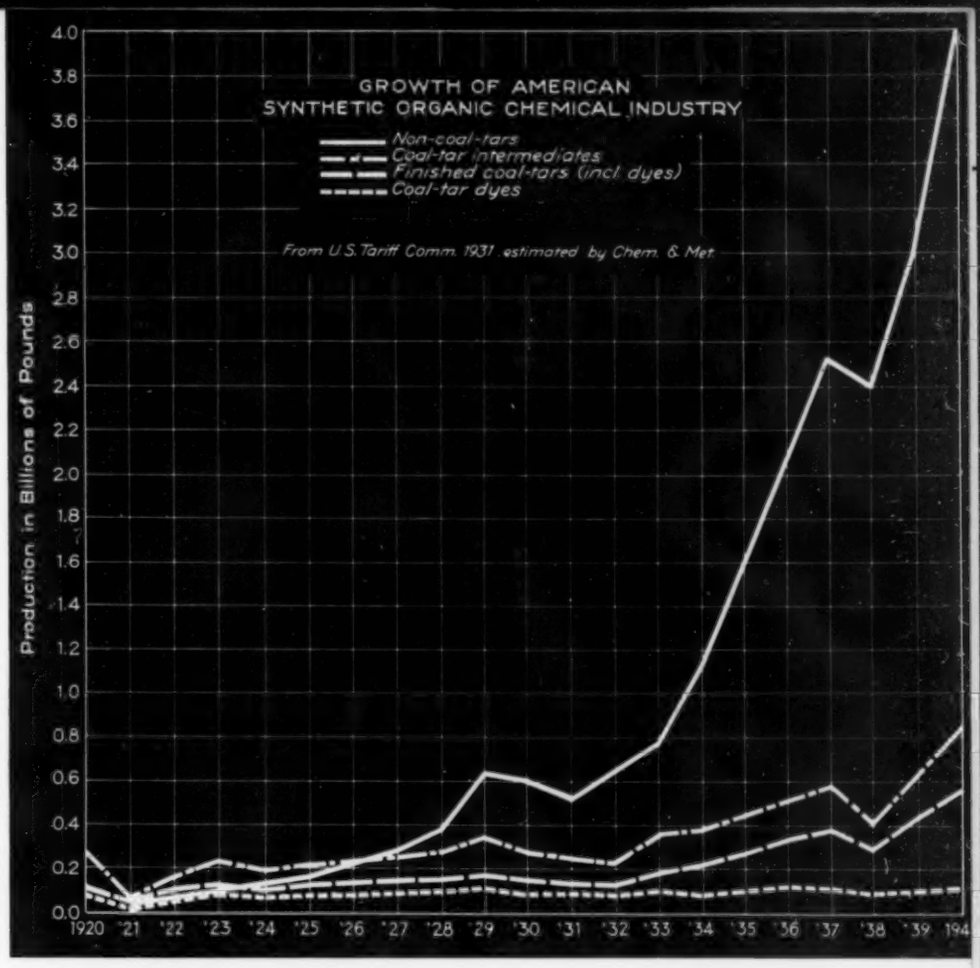
these processes have been investigated only within the last ten years.

Outstanding among the commercial catalytic synthetic organic processes are those that produce methanol from CO and H_2, urea from ammonia and carbon dioxide, ethyl alcohol from ethylene, acetone from isopropyl alcohol, phthalic anhydride from naphthalene.

Inter-Relationship of Products—As previously mentioned, the synthetic organic chemical industry has two primary sources of raw materials. Given sufficient coke-oven gases and tars and certain inorganic chemicals, a manufacturer is in a position to produce any one or all of the approximately 2,000 commercial synthetic organic compounds derived from these basic raw materials. And given certain refinery and natural gases containing the usual saturated and unsaturated hydrocarbons, he could manufacture probably 90 percent of the 500 non-coal-tar synthetics now in commercial use.

Thus in this industry, probably more so than in any other branch of the chemical products industry, there exists an intricate and apparently endless relationship between raw materials and products and by-products. In a sense, this relationship is similar to a geometric progression, constantly increasing itself by making each material the starting point for others. Theoretically there is no limit. Economically, however, the limit is reached whenever processing costs pile up to such an extent as to limit the market. It is because of this accumulation of costs that those chemicals furthest away in processing from the basic raw materials are usually the most expensive. They are frequently high-priced, small-tonnage products such as certain of the medicinals, dyes and perfumery materials.

When this stage of cost saturation is reached the industry can, and does, resort to one of several ways to break the stagnation and extend the line of derivatives. It can (1) improve the process in some radical manner so as to reduce manufacturing costs (such as the substitution of a cold catalytic process for one requiring high temperatures and pressures); (2) find a cheaper and more basic raw material (such as using ethylene instead of ethylene chlorohydrin as raw material for ethylene oxide); and (3) develop uses to such an extent that markets will be greatly expanded and unit manufacturing costs lowered (as in the case of furfural from oat hulls).



In 1940 United States production of all synthetic organic chemicals was about 5,500 million pounds: an increase of around 11,000 percent over 1920. Although sales value is many times that of sulphuric acid, total annual production of these organics is still less than one-third that of the acid.

AMERICAN DEVELOPMENT

Many persons are under the impression that no American synthetic organic chemical industry existed before the first World War when imports of German dyes and other chemicals were suddenly cut off. Actually, however, this country had a small dye industry before that time. The Schoelkopf Aniline & Chemical Works was organized in the United States in 1879 to make aniline, dyes and other coal-tar derivatives. In 1914 there were seven establishments in the coal-tar chemical industry with 528 employees. Production of coal-tar dyes in that year amounted to over 6,600,000 lb. (as compared to 128,000,000 lb. in 1940). However, this dye production was almost entirely dependent upon German intermediate products.

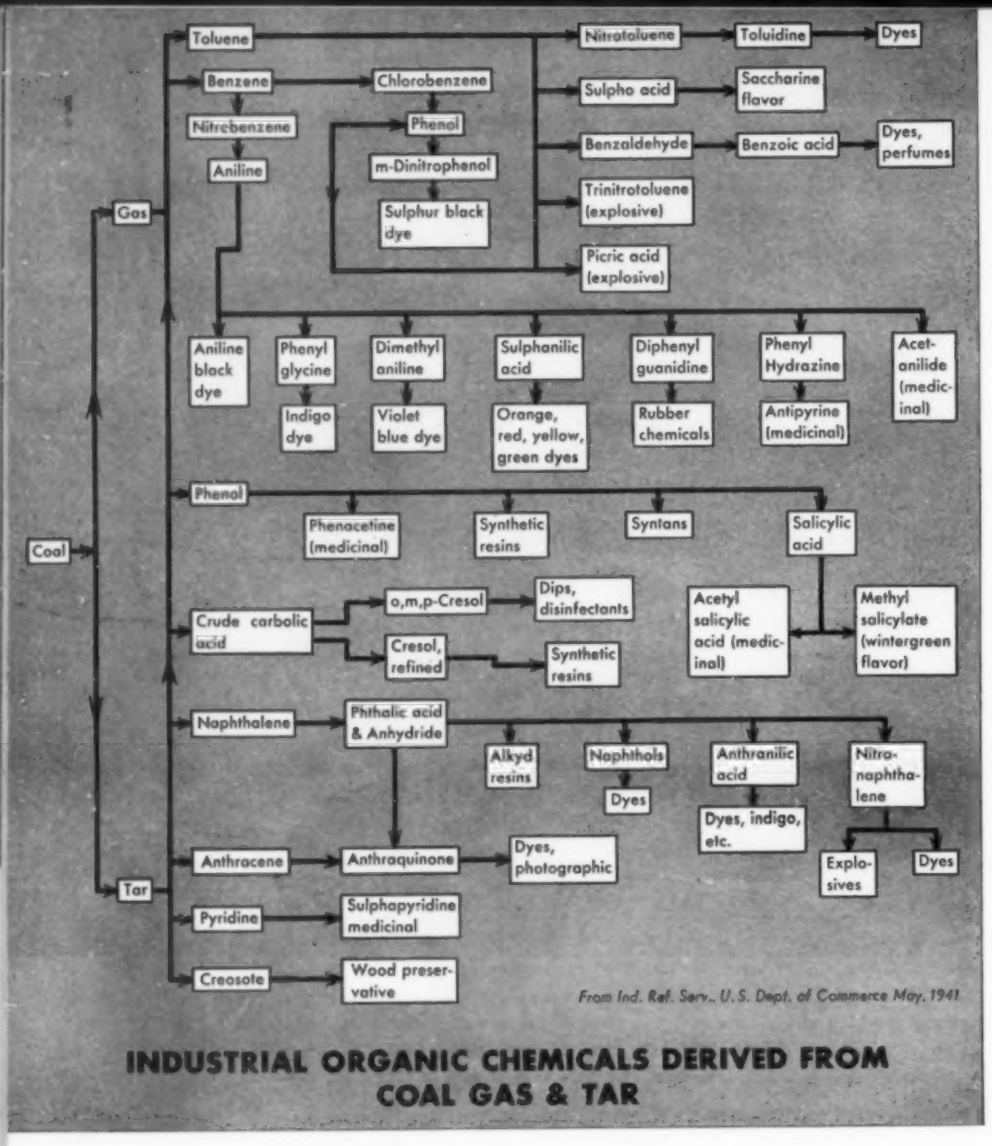
Coal-Tar Derivatives—The sudden cessation of German imports caused an immediate shortage of dyes and other organic chemicals in this country. American research chemists were faced with the necessity of quickly devising methods of manufacture for these complicated products under the triple handicaps of lack of knowledge, shortage of technically trained men and restrictions of German patents. In 1918, however, the creation of the Chemical Foundation, Inc. made possible the issuance of licenses for the use of these German chemical patents. About the same time the American development of the vapor-phase catalytic oxidation of naphthalene to phthalic anhydride, and of an improved process for the manufacture of anthraquinone from phthalic anhydride and benzene gave impetus to the struggling domestic industry.

So rapid was the development of the coal-tar chemicals industry that from 1914 to 1918 the number of domestic producers increased from 7 to 190 and the number of employees from 528 to 27,233. In the latter year the reported research expenditures were in excess of $4,500,000 and 8.5 percent of all employees were chemists or otherwise technically trained. The subsequent development of the Ameri-

Table I—Non-Coal-Tar Synthetic Organic Chemicals Number of Chemicals and Total Tonnage Production [1]

	Medicinals		Flavors & Perfumes		Rubber		Chemicals		Miscellaneous	
	Number of Items	Production, 1,000 lb.	Number of Items	Production, 1,000 lb.	Number of Items	Production, 1,000 lb.	Number of Items	Production, 1,000 lb.
1929	..[2]	.....[2]	..[2]	.....[2]	..[2]	.....[2]	245	405,186
1933	47	422	..[2]	.....[2]	..[2]	.....[2]	263	767,581
1935	63	751	..[2]	.....[2]	..[2]	.....[2]	302	1,591,896
1937	74	1,314	72	1,803	21	.....[2]	277	2,505,027
1939	83	1,668	94	2,137	27	13,122	318	2,984,037

[1] Compiled from U. S. Tariff Comm. Census of Synthetic Organic Chemicals.
[2] Included under "Miscellaneous". Individual data not available.



INDUSTRIAL ORGANIC CHEMICALS DERIVED FROM COAL GAS & TAR

can coal-tar industry is well known and reflects the ingenuity and courage of the chemical industry.

Refinery Gas Derivatives—In 1922, when isopropyl alcohol was first manufactured on a commercial scale from petroleum refinery propylene gas, the American synthetic organic industry entered, perhaps unwittingly at the time, a new and profitable era—that of using refinery and natural gases as raw materials. Since that time an extremely wide variety of alcohols, ketones, esters and other compounds have been introduced on the market for a host of applications.

These refinery and natural gas derivatives largely make up the so-called "non-coal-tar" group of organics. A glance at the chart showing the growth of the American synthetic organic chemical industry dramatizes the spectacular rise and over-shadowing importance of this division of the industry. Prior to 1914 there was practically no manufacture in the United States of any synthetic organic chemicals other than those of coal-tar origin, with the exception of a few compounds produced by relatively simple and inexpensive processes. These included acetone, chloroform, ether, acetic acid, formaldehyde, acetaldehyde, amyl acetate, vanillin and a few others.

Table III—Production of Coal-Tar Synthetic Organic Chemicals[1]

In Thousands of Pounds

	1920	1940	Increase 1940 over 1920 Percent
Intermediates	257,727	805,807	213
Finished products:			
Dyes	88,264	127,834	45
Medicinals	5,185	18,208	250
Flavors & perfumes	266	4,490	1,964
Resins	4,660	222,943	4,684
Others	14,567	148,385	918

[1] U. S. Tariff Comm. Census of Dyes and Other Synthetic Organic Chemicals.

In 1921 production of all non-coal-tar synthetics amounted to 21.5 million pounds, of which ethyl acetate and ether alone accounted for over eight million pounds. In 1940 the corresponding production figure was almost four billion pounds, representing an increase of about 18,500 percent over 1921 and 31.6 percent over 1939.

Such percentage growth figures, however, are difficult to grasp. For this reason, a comparison has been made for 1939 soda ash figures, as reported by the Census Bureau, and 1939 synthetic organic chemicals of non-coal-tar origin as reported by the U. S. Tariff Commission.

Table IV—Comparison of Soda Ash and Non-Coal-Tar Synthetic Organic Chemicals, 1939

	Soda Ash	Non-Coal-Tar Synthetic Organics	Organics to Soda Ash, Percent
Production[1]	5,923	3,035	51
For sale[1]	4,292	1,532	36
Sales value[2]	$32,871	$199,698	610
Value per lb.	$0.008	$0.130	1,625

[1] In millions of pounds.
[2] In thousands of dollars.

When thus compared with soda ash, second most important industrial chemical on a tonnage basis, it is seen that the importance of the non-coal-tar organics lies not in the quantities involved but in their value. When it is realized how much a few cents' worth of lead tetraethyl will increase the value of gasoline and the efficiency of an engine, or how a pinch of antioxidant will prolong the life of an automobile tire, then the true worth of these chemicals becomes apparent.

Refinery and natural gas organic derivatives represent a purely American development just as the coal-tar chemicals were largely a German achievement. The United States, although not the only large producer of petroleum, has shown the most remarkable progress in the development of petroleum chemicals. This progress has been made possible by the multiple combination of:

1. Ingenious research workers who pioneered by developing products and processes from petroleum hydrocarbons well known for their lack of reactivity;
2. Practical engineers who isolated and produced relatively pure hydrocarbons on a large scale and who took laboratory processes and developed them into plant operations without losing control of equipment and manufacturing costs;
3. Manufacturers, represented by far-sighted executives, who often gambled on chemists' dreams and engineers' estimates to invest money in radical processes and products with no uses, and who were patient about returns on investment; and
4. Technical salesmen who started out with ounce bottles of virtually unknown chemicals, developed new uses, expanded markets, and returned with orders for car-load quantities.

RECENT TRENDS

Other than the long-term trend toward the use of refinery and natural gases as raw materials to produce a rapidly increasing volume of non-coal-tar derivatives, several distinct trends have recently developed within the industry. These, interpreted in the light of normal conditions, may indicate future developments. On the other hand, the present emergency, the outcome of the war and world conditions

Table V—American Synthetic Rubber Production[1], Long Tons

	Neoprene	Butadienes	Polysulphides	Butyl
1939.....	1,750	None	500	None
1940.....	2,500	60	700	Exp.
1941 (est.)..	6,300	4,000	1,400	No data
1942 (cap.)[4].	19,200	50,400[2]	18,000	4,800

[1] E. R. Bridgwater, E. I. du Pont de Nemours, Amer. Chem. Soc., Sept. 11, 1941.
[2] Includes 39,600 tons of butadiene-styrene interpolymers, plants which will be owned by the Government.
[3] Includes plasticized polyvinyl chloride.
[4] As at the end of 1942.

after peace may upset all predictions and reverse all trends. Several possibilities, however, will be briefly discussed.

Synthetic Resins—The rapid vertical growth of synthetic resins began about 1932 and even the depression could not hold back this vigorous up-start. Coal-tar derivatives represent by far the largest tonnage, but this branch had a good start long before the non-coal-tar resins ever existed. The coal-tars are represented in large tonnages by derivatives of maleic and phthalic anhydrides and the tar acids such as the phenols and cresols. The smaller group is represented by those derived from coumarone and indene, polystyrene, and xylenols. Non-coal-tar resins are represented by urea derivatives, largest in tonnage, as well as those derived from acrylic acid esters, abietic acid, and vinyl acetal, acetate and chloride.

Growth of synthetic resins has stimulated a heavy demand for a number of coal-tar intermediates as well as of miscellaneous organic chemicals. For instance, increased resin production largely accounted for the 31 percent increase in 1940 as compared to 1939 in the production of phthalic anhydride and acid, 40 percent increase in phenol and 100 percent increase in maleic acid and anhydride. That synthetic resins will continue to expand cannot be doubted, and it was only recently announced that production for 1941 is expected to run some 200 percent ahead of that for 1940. The present shortage of metals offers a golden opportunity for the resins, although raw material shortages now begin to offer serious problems. Post-war competition from cheap aluminum, magnesium and copper may cause trouble.

Synthetic Rubbers—As a result of defense efforts, the synthetic rubbers are rapidly taking on added importance as consumers of synthetic organic chemicals such as butadiene from butane, vinyl derivatives from acetylene, styrene and ethylene dichloride from ethylene. Most of the large-tonnage, recently-developed synthetic rubbers are derived from petroleum gases and within a few years (under war conditions) will represent a tremendous industry.

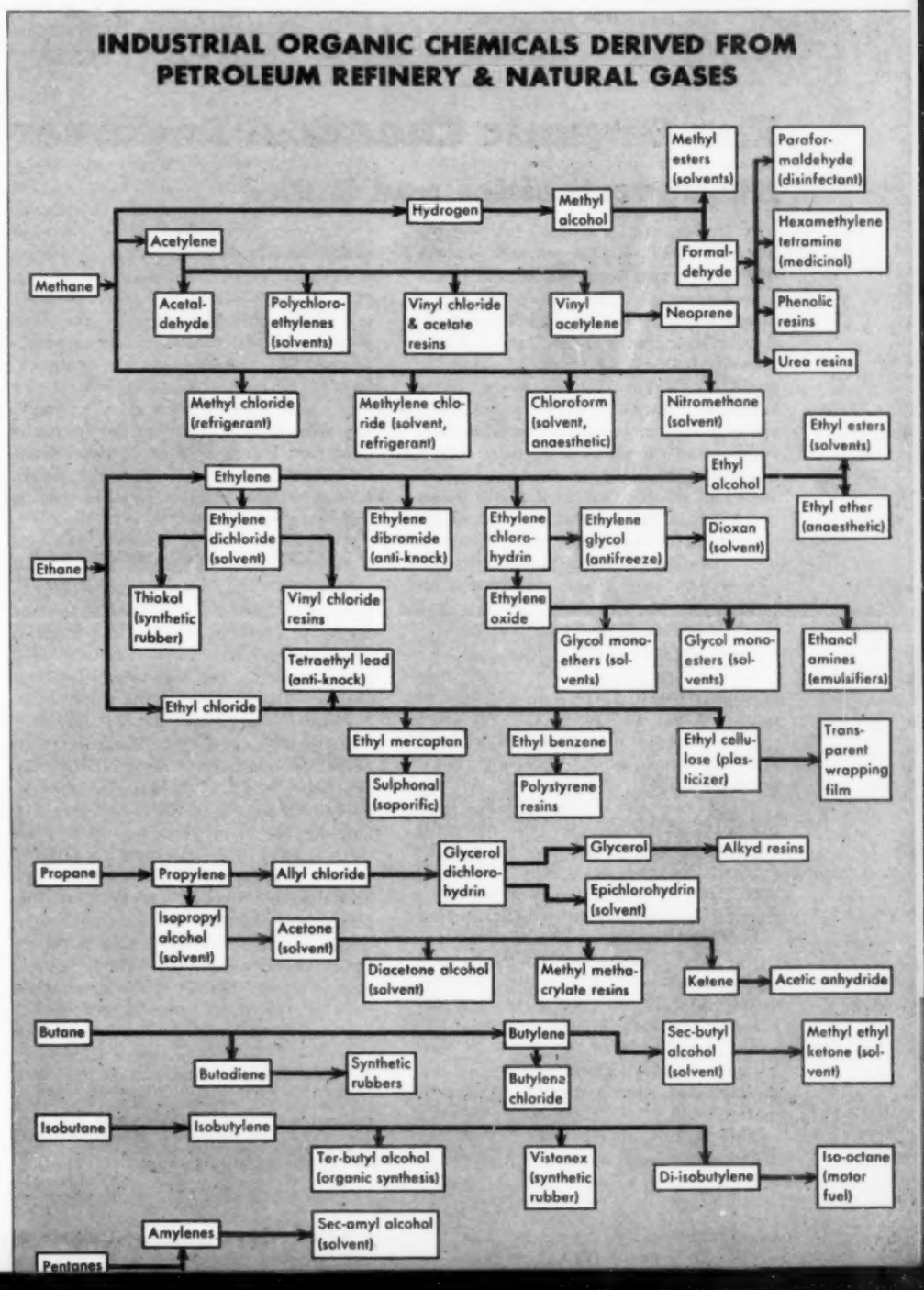
Fate of synthetic rubbers after the war, assuming the defeat of the Axis powers, is not particularly promising. Competition from natural rubber will again increase for tonnage uses, although undoubtedly certain of the synthetic products will find additional specialized uses which cannot be filled by the natural material. Loss of these war-developed markets will, of course, be reflected in the organic industries supplying the raw materials.

Miscellaneous Products—Just as the resins have stimulated production of formaldehyde and coal-tar intermediates, in like manner the increasing applications of solvents within recent years have been a major factor in causing the tonnage of non-coal-tar chemicals to increase so spectacularly. Synthetic methyl, ethyl, butyl and isopropyl alcohols and many of their derivatives, acetone, carbon tetrachloride, furfural and a few other solvents probably accounted for as much as 30–35 percent of all non-coal-tar derivatives in 1940.

Because of the great increase in the production of cellulose acetate for rayon, lacquers, film and resins, acetic acid and anhydride are required in larger tonnages than most other synthetic organic chemicals. Domestic production of acetic acid and its derivatives, based on 100 percent acid, has increased from an estimated 85 million lb. in 1930 to approximately 255 million lb. in 1940.

Nylon and other synthetic fiber materials are naturally stimulating production of organic intermediates. Also steadily growing in importance are the synthetic medicinals, rubber chemicals, flavors and perfumes, photographic chemicals, and others.

Research and Engineering—The synthetic organic chemical industry has



always had an enviable record of research activities. In 1940 this industry employed 2,692 research workers or 18.4 percent of the 14,661 research workers in the chemical and allied products industries or about four percent of such workers engaged by all industries. These ratios are certainly high when compared to the size of the industry or to the value of its products. In 1940 the industry spent 3.3 percent of the value of its sales for research as compared to about one-fifth of one percent so expended by American industry as a whole.

Certain engineering trends in equipment design and processing are also discernible. Catalysis and high-pressure, high-temperature reactions, entailing special problems in equipment design and materials of construction, are coming to the fore. Processes are rapidly becoming more complicated, thus requiring highly skilled engineering work for industrialization. The industry is already noted for its large amount of automatic control and this will undoubtedly increase as processes and equipment become more complex. As many of the manufacturing processes used in organic chemistry are batch operations and as many of the reactions give relatively low yields, there will certainly be an increasing amount of engineering talent concentrated toward continuous processing and devices for improving yields.

Since larger numbers of synthetic organic chemicals are being made from petroleum refinery and natural gases, engineering trends will probably continue to focus around such problems as gas handling, high temperature and pressure equipment design, fractionation, heat transfer, polymerization conditions and safety features. For instance, in 1939 alone, there were issued in this country 139 patents for producing organic chemicals from petroleum gases by cracking.

Table VI—Research Expenditures in the Synthetic Organic Chemicals Industry [1]

Year	Research Workers	Net Cost of Research	Percent of Sales
		Total	
1933.....	1,060	$6,163,688	5.0
1934.....	1,350	7,629,694	4.3
1938.....	1,603	10,449,000	4.3
1939.....	2,197	13,064,000	3.5
1940.....	2,692	16,200,000	3.3

[1] From U. S. Tariff Comm. Reports.

The Organic Chemical Engineer

His Opportunities and Duties

CHEMICAL engineers, both in research and development and in engineering work, have always played a prominent part in the synthetic organic chemical industry. In fact, White (Amer. Inst. Chem. Eng., *Trans.* **27**, p. 221-52, 1931), found that organic chemicals ranked second only to petroleum in accounting for nine percent of the chemical engineering graduates of the 1920-1929 classes. It was stated by the U. S. Tariff Commission in 1929 that the dye and coal-tar chemical industry probably had a higher proportion of technically trained employees than any other manufacturing industry in the United States. In that year chemists and other technically trained employees constituted 15.1 percent of all employees. No recent comparable data are available, but it is certain that this proportion of technical to non-technical men is still head and shoulders above American industry as a whole.

What are the opportunities, both present and future, for the chemical engineer in this technically-minded industry? Is the field still "free-and-open" or is it approaching an equilibrium between chemical engineering supply and demand, a position of maturity and near-saturation? And to those who hope to enter into this industry: What are the duties of the chemical engineer in the synthetic organic chemical field, what salary can he expect, what qualifications should he have and what are his lines of promotion?

This section of the report is an endeavor to answer some of the above questions. It is a message from the synthetic organic chemical industry, through the editors of *Chem. & Met.*, to all chemical engineers now employed or hoping and preparing themselves to be employed by the industry. It is an introduction, though brief and incomplete, of the industry to chemical engineering students, written with the hope that it will help them become better prepared for service within the profession of organic chemical engineering.*

DISTRIBUTION OF ENGINEERS

Here it would probably be best to examine the basic classification of duties in the organic field and to evaluate the relative importance of each in respect to the proportion of all chemical engineers employed.

Employment by Types of Duties—The total number of chemical engineers or chemists employed by the synthetic organic chemical industry has never been compiled. Latest available figures show that for 1929 there were 1,701 chemists and technically trained employees in the coal-tar dye and chemical industry alone. The corresponding figure for the entire synthetic organic field must now be many times the above; this editor's guess, based upon sketchy information, is that it is about 8,000-12,000. As to how many of these are chemical engineers, there are neither figures nor guesses. One large company reported that in 1940 some 3.6 percent of its employees held bachelor of science or engineering degrees and an additional 1.1 percent held doctor's degrees.

There are interesting but rather old figures which were recently published by the U. S. Dept. of Labor on the employment distribution of chemical and ceramic engineers in 1934. These figures, classified into certain age groups and showing changes in type of work with increasing age, are shown in Table VII. Somewhat similar information on chemical engineers who graduated from 1920-1930 inclusive has been compiled by White (see above).

Comparable data for the synthetic organic chemical industry were supplied by two of the larger manufacturers who classified technical employees engaged in active technical work as in Tables VIII and IX.

From the data of one concern it is seen that, neglecting those in sales work, the proportion of chemical engineers in production increased from 71 percent of the total in 1930 to 77 percent in 1940, those in research and development decreased from 16 percent in 1930 to 12 percent in 1940, while those in engineering and design decreased from 13 percent to 11 percent. A very rough break-down of the membership of the American Institute of Chemical Engineers employed by firms that manufacture organic chemicals, showed approximately 47 percent engaged in production and engineering work, 15 percent in research and development, 11 percent in general administration, 7 percent in sales and sales development, with all other classifications accounting for the remaining 20 percent.

Trends in Employment—That chemical engineers are being employed on an increasing scale in the synthetic organic field should not be doubted by anyone familiar with the progressive temperament of the industry. But what is the actual magnitude of this trend?

One producer of both organic and inorganic chemicals showed the accelerated employment of chemical engineers by recent employment figures as follows:

	Chemists	Chemical Engineers
1936	10	6
1937	12	12
1938	10	8
1939	16	18
1940	21	31
1941 (to date)	40	49

* The editors wish to express here their sincere appreciation to all those persons in the various companies who so readily co-operated to make this report possible, and who freely gave their time and energy under conditions when both time and energy command a premium.

Table VII—Chemical and Ceramic Engineers Reporting Type of Work[1] As of December 1934

Type of Work	Engineers Born 1910–14	1907–09	Prior to 1907
Operation	62.7%	56.8%	35.5%
Design & research	29.8	31.9	34.2
Construction	1.6	2.8	2.4
Sales	1.2	1.8	4.2
General administration & management	1.1	2.0	7.5
Consulting	2.0	1.8	6.2
Teaching	1.6	2.9	10.0

[1] Employment and Earnings in the Engineering Profession 1929-1934. Bulletin 682, U. S. Dept. of Labor (1941).

Another firm manufacturing synthetic organic chemicals almost exclusively summarized the percentage increase in chemical engineers at the end of 1940 over 1930 in the following manner:

	Percentage Increase 1940 over 1930
Chemical engineers, total	252
Production	285
Research & development	167
Engineering & design	180
Technical salesmen (Ch.E., Chem., etc.)	339
All technical employees	255

The first impression from these figures is that increasing numbers of chemical engineers are entering into the synthetic organic field. Will this trend continue at its present accelerated rate or will it tend to slow down? The probable answer was given by one executive as follows:

> "It is difficult to forecast the demand for chemical engineers in the future. A great deal will, of course, depend on the kind of peace which we are going to have. If this country should be called upon to furnish organic chemicals for many years to come to countries formerly supplied by Germany, there would, of course, be a large demand for chemical engineering talent. Over a period of years, however, I do not think that the increase in demand of engineering talent would parallel that which we have experienced during the last twenty years."

Similar statements were emphatically voiced by another executive who warned that predictions based upon trends were particularly dangerous in view of the present world instability.

Table VIII—Distribution of Technical Employees, Company A

	Percent of Total Technical Staff Dec. 1930	Dec. 1940
Production:		
Chemical engineers	23.6	25.6
Chemists[1]	12.7	15.1
Other engineers	12.7	12.3
Research & development:		
Chemical engineers	5.4	4.1
Chemists	10.0	7.3
Other engineers	0.0	0.5
Engineering & design:		
Chemical engineers	4.5	3.6
Other engineers	0.9	2.5
Sales:		
Technical graduates	30.2	29.0

[1] Including those in analytical work.

This authority expressed the opinion that, even though the industry should return to a healthy and vigorous growth within a few years, the demand for chemical engineering talent would certainly not be so great as to create a shortage or to lower standards. He warned that there would be no place for misfits who wedge into the profession, quickly slide into a downward spiral and become the dregs of the engineering profession.

Opportunities in Engineering—After having stressed processing and chemical aspects in its earlier days, the synthetic organic chemical industry has since been concentrating on advancing by means of more applied engineering. Modern industrial organic processes depend for their success as much upon design of special equipment as upon the chemistry of the reactions. Realizing that this trend toward applied and specialized engineering will probably be continued at an accelerated rate, one authority recently stated that "organic chemical engineering is the engineering of the future."

Such engineering offers a peculiar, but real opportunity for those inclined toward the strictly engineering aspects of the profession. This opportunity consists in the conversion of inefficient batch processes into efficient continuous methods. There are other chances to improve yields, which are often low in the organic as compared to the inorganic field, by improving equipment design, instituting better control of reactions, and through fundamental studies.

The present status of engineering in certain divisions of this field may be compared somewhat to that existing in petroleum refining back about 1920 when chemical engineers substituted precise fractionating columns for the old, inefficient dephlegmators and thus increased yields and avoided the necessity for re-running many products. These saved as much as one cent per gallon which, multiplied by the billions of gallons of gasoline sold, gives a good idea of why the petroleum refining industry is the number one employer of chemical engineers.

A brilliant example of similar revolutionizing engineering work in the synthetic organic field lies in the story of the recent commercialization of certain synthetic vitamins. These products, formerly prepared by batch processes involving at least a dozen distinct reactions, were necessarily rare and expensive. By its application of chemical engineering technique to devising continuous synthetic processes and to improving yields, one manufacturer has been so successful as to make his name almost always associated with the term "synthetic vitamins."

Engineers in Technical Sales—One trend in the industry that stands out predominantly is that of the rapidly increasing employment of chemical engineers in sales, technical service, and market development. One large organization, eminently successful in developing new markets and new products, has a technical service and sales organization that is 100 percent chemically trained. Another reported about 40 percent of its chemical engineers in development work as being in the technical service and sales division, and stated that this figure was rapidly increasing. Chemical engineers seem to be especially successful in this type of work. One executive expressed an interesting line of thought:

> "After this emergency has passed there will probably be a surplus of chemical engineers. Many of them will undoubtedly not return to their former positions for the reason that younger men will have taken their places in non-defense industries. This surplus of chemical engineers . . . will probably find a way into other positions, perhaps into operating positions or into sales work. As you undoubtedly know, technically trained men are used in increasing numbers in the field of application, which activity is usually attached to the sales division."

Summarized, production and technical sales seem to be the strongest magnets at the present for chemical engineering talent. Production still probably stands far ahead in numerical rating while technical sales, relatively low on the scale in actual numbers, has the most pronounced growth trend. Development work still employs a goodly number of chemical engineers, while pure research seems to be losing ground with this profession. Strictly engineering work, such as design, offers real opportunities for the future but still takes a relatively small percentage of all chemical engineers in the synthetic organic field.

THE FIRST YEAR

To the young chemical engineer who plans to enter into synthetic organic chemical engineering, the vital problems are employment technique, starting salary and first duties.

Companies differ in their technique of handling applicants for jobs. At least one leading firm has no regular personnel director, feeling that the plant men or other persons concerned should interview the applicant and make the final decision. This firm believes that employment of such methods

Table IX—Distribution of Chemical Engineers, Company B

	1920	1930	1940
Total technical employees[1]	500	2,000	3,500
Percentage chemical engineers[1]	18	30	41
Distribution of chemical engineers:[2]			
Research & development	1	2	2
Engineering & design	2	3	3
Operations & control	3	1	1
Sales & technical service	4	4	4
Administration	5	5	5

[1] Approximate.
[2] In approximate order of numerical rating.

tends to eliminate misfits. Another company, which in 1939 received more than 3,000 applications monthly, has a personnel division which selects the applicants for interviews with executives of departments in which the vacancies occur.

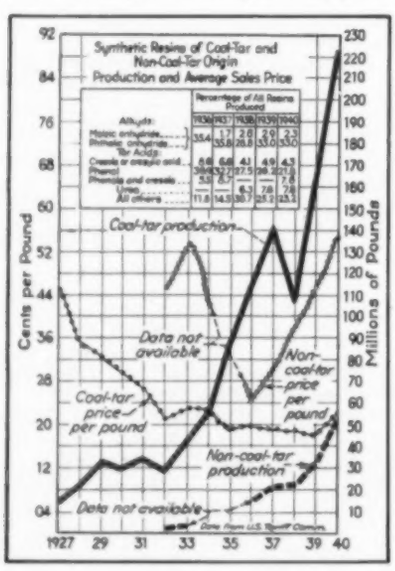
Starting Salary—In connection with initial salary to be expected by the young chemical engineer entering industry, the following figures compiled by the U. S. Dept. of Labor for the median monthly earnings of first-degree chemical and ceramic engineers immediately after leaving school are of interest:

	Years after Graduation	
	First	1–2
1929.....	$150	$179
1932.....	108	124–144
1934.....	107	114–122

Comparable data compiled by White for all chemical engineers graduating from 1920 to 1930 showed that the median salary for the first year after graduating was $150 per month and $158 and $183 per month for the second and third years respectively. In comparison to these figures of a few years ago, data on the monthly starting salary for chemical engineers entering the synthetic organic chemical industry in 1940 are summarized as follows:

Company	Engineering Graduate	Master's Degree	Doctor's Degree
A.....	$140	.....	$200
B.....	125	150–160	200–225
C.....	130–140	.....	.....
D: 1920..	110	.....	.....
1930..	130	.....	.....
1940..	145	.....	.....

A period of apprenticeship, varying in time from six months to one or two years, is usually served by the young engineer in the organic industry. One company has a one-year apprenticeship period, the first six months of which are usually spent in routine analytical control. It feels that this type of work teaches the apprentice more about the products and processes than work of a more specialized nature. After the period of apprenticeship, the engineer goes into production, technical service or some other branch for which he has shown special interest and aptitude.


Synthetic Resins of Coal-Tar and Non-Coal-Tar Origin
Production and Average Sales Price
Percentage of All Resins Produced
1936 1937 1938 1939 1940
Alkyds:
Maleic anhydride
Phthalic anhydride
Tar Acids:
Cresols or cresylic acid
Phenol
Phenolics and cresols
Urea
All others
35.4 17 28 29 23
55.8 28.8 53.0 53.0
6.6 6.6 4.1 4.9 4.3
5.8 15.7 — — 17.8
— — 6.3 7.6 7.6
11.8 14.5 38.7 25.1 23.5
Coal-tar production
Data not available
Non-coal-tar price per pound
Coal-tar price per pound
Non-coal-tar production
Data not available
Data from U.S. Tariff Comm.
Cents per Pound
Millions of Pounds
92 84 76 68 60 52 44 36 28 20 12 04
230 220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10
1927 29 31 33 35 37 39 40

QUALIFICATIONS NEEDED

Thorough training in fundamentals of chemical engineering was stressed time and again by men in the industry as probably being the most important single qualification for success. In fact, it is considered that a minimum of five or six years of college study is becoming necessary to train a chemical engineer properly. When there was question as to whether a specialized senior course in "organic chemical engineering" would be desirable, the answer was overwhelmingly in the negative. An one executive expressed his ideas on the matter:

> "In my opinion, it is a mistake to try to train chemical engineers for a specific field while they are still undergraduates. If they have any extra time they could probably go through the fundamental courses twice with profit, particularly those on English. The chances of a man being able to catch a job in exactly the spot for which he is trained seem to me rather small in ordinary years, however likely it might have been in 1941."

Research and Development—Research is not the special domain of the chemical engineer although many engineers willingly enter into such work and become highly successful. The advantages of chemical engineering training do not stand out so prominently in this field as in other chemical activities and pure research is becoming increasingly dominated by chemists with advanced educational training. However, if a chemical engineer is attracted toward research there is no reason why he should not enter the field. His practical engineering training and experience will often come in good use as an aid in determining the economic feasibility of a proposed process in its early stages of development.

Development work on a pilot plant or semi-plant scale is particularly adaptable to chemical engineering principles and practice. It is here that the engineer's training and temperament often save from disaster projects which later become industrial successes. Especially valuable in such work is a practical knowledge of equipment design and materials of construction, unit operations, and the ability to gage the economics of processing and of materials handling.

Engineering and Design—Strictly engineering design and construction work employs a relatively minor proportion of chemical engineers in the synthetic organic chemical field. One large and representative firm reported that in 1940 these employed 11 percent of all its chemical engineers.

Qualifications for this type of engineering are strict and misfits are quickly eliminated. Other than good training in basic principles of chemical engineering, the aspirant should have a "knack" and love for such work as well as a sense of practical values. An engineer can often work wonders in equipment design, plant layout, processing control, and yield improvements simply by applying a controlled imagination to sound engineering and economic principles. In it, more so than in certain other activities, the chemical engineer has the opportunity for doing an outstanding service to the industry and the profession of applied "organic chemical engineering."

Production — The engineer entering production work should have several qualifications. Other than a good basic knowledge of organic chemistry and engineering, especially equipment, he should be able to apply this knowledge quickly to unexpected problems. He should, by all means, really like this type of work, not be afraid of hard manual labor at times, be able to get along with people and command the respect of the plant operators. He should always remember that the one primary duty of a production man is to produce at a *maximum of efficiency and a minimum of expense.* Production work in the synthetic organic plant is more complicated than that in most inorganic plants and hence requires a very high degree of engineering practice. Yields, quite low in a number of organic reactions, must be watched closely or else losses will increase the cost of the product. The engineer who can increase his plant's overall yield by a few percent will often assure himself of outstanding success in his organization.

Marketing and Sales—These divisions of the organic industry are rapidly becoming more technical-minded and chemical engineers often find excellent opportunities in such activities. The type of work is usually pleasant, often calling for a combination of original testing work, plant visits, engineering applications, salesmanship, and statistical and economic analysis. As one executive pointed out, this work is unusually broadening for the young engineer because of the diversity and practical nature of the problems, the different types of people, plants, equipment and processes that must be encountered first-hand, inside information gained on the intricacies of chemical marketing and the realization that economic values determine and guide all activities in the field. For these reasons, one large organization has found that technical sales is the best recruiting ground for administrative personnel and executives.

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Machinery, Materials and Products

Chem & Met Process Equipment NEWS

pH Indicator

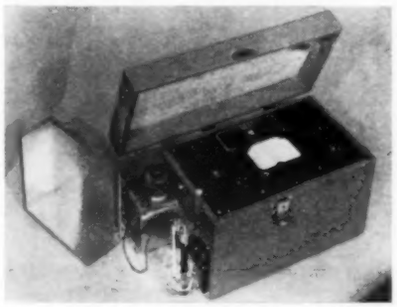
HIGH ACCURACY, as much as is needed in many laboratory measurements and in practically all plant tests is claimed for a new simplified glass-electrode pH indicator recently announced by Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia, Pa. The new instrument, which is of the portable type, is said to retain full accuracy up to 85 deg. F. in atmospheres as moist as 95 percent relative humidity. Measurements are stated to be consistently accurate within ±0.1pH. Features include simplified adjustments, manual temperature compensator calibrated in 1-deg. divisions, and highly stable, factory-filled and sealed electrodes.

Continuous Centrifugal

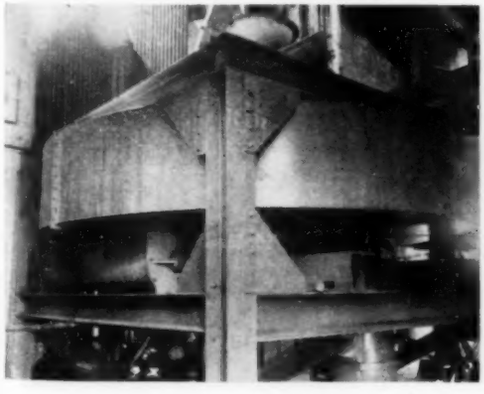
A DEVELOPMENT, stemming from the old Elmore centrifugal, but completely redesigned and made by a new concern, is the C-M-I line of continuous centrifugal dryers and clarifiers now being manufactured by Centrifugal & Mechanical Industries, Inc., 146 President St., St. Louis, Mo. These centrifugals are of the vertical type. Material is fed on to the top of a rotating cone carrying spiral scraper flights. This cone is supported within a conical screen frame which rotates at a slightly higher speed than the cone. The screen frame is supported on a vertical hollow shaft, driven from a motor by means of V-belts. Within the hollow shaft is a solid spindle shaft supporting the solid cone. The two shafts are tied together by a differential gear lock, so designed as to give the slight speed differential mentioned.

As material strikes the top of the solid cone it is thrown off on to the inner surface of the screen frame, the liquid passing through under centrifugal force and the solids retained on the surface. As they build up the solids are carried downward toward the large end of the screen frame by the spiral flights, being subjected constantly to greater centrifugal force as the diameter of the screen increases. Liquid discharges into a conical casing surrounding the screen, while solids discharge at the bottom of the screen. Two types are built, gravity discharge and mechanical discharge. In the former solids drop into a conical hopper beneath the centrifugal and discharge from the bottom to a conveyor; in the latter, solids discharge into an annular chamber equipped with a rotating scraper which moves them to a single point at one side for discharge. Two sizes are built at present, the 26-in. (referring to the large diameter of the screen) and the 48-in. The former is provided only in the mechanical discharge type, while the latter employs either gravity or mechanical discharge.

Portable pH indicator



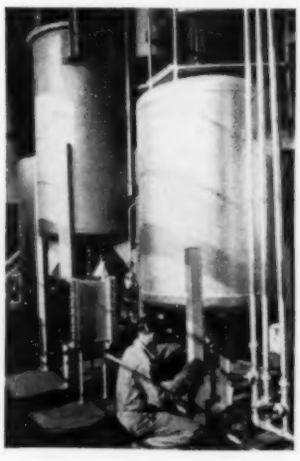
C-M-I continuous centrifugal dryer



Improved Extraction Unit

A RECENT INSTALLATION of an extractor, solvent-recovery still and decantation tank for the separation of fine chemicals and pharmaceuticals, shown in the accompanying view, was designed and built by L. O. Koven & Brother, Inc., Jersey City, N. J. The equipment, built of stainless clad steel to insure freedom from contamination, has several interesting features. The decantation tank to the left of the operator is equipped with an agitator shaft with two stainless steel propellers. The motor and shaft are mounted at an angle so that the propellers can be adjusted to any desired position in relation to the liquid. The decantation device can be raised or lowered to any desired level. The sight box below the decanter, through which the decanted liquid passes, is equipped with a shock-proof glass front and rear, and allows the operator to control the position of the decantation funnel by noting the clarity of the liquid.

Extraction unit for fine chemicals and pharmaceuticals



Fabric Permeameter

FOR THE RAPID determination of permeability of coated fabrics, such as those used for gas-proof clothing, gas masks and balloons, Cambridge Instrument Co., Grand Central Terminal, New York, N. Y., has introduced a new instrument, known as the Fabric Permeameter, which utilizes the thermal conductivity method of gas analysis in determining the rate of diffusion of gas through fabric. Its primary purpose is for testing the effectiveness of various coatings with which fabrics are treated for purposes such as those suggested.

The sample to be tested is clamped between two recessed plates, thereby forming upper and lower compartments separated by the fabric. Hydrogen is passed into the lower compartment, while the upper compartment is filled with clean, dry air communicating with the metering unit. Hydrogen passing through the fabric contaminates the air in the upper compartment, thus changing its thermal conductivity and registering on a portable spot galvanometer calibrated to

Fabric permeability tester

read in liters leakage per square meter per 24 hours. Accessory equipment included is a double-disk device to permit dipping the edges of the test fabric in a hot sealing mixture to prevent leakage along the layers of the textile.

Air-Powered Mixer

AVOIDANCE of fire and explosion hazards is claimed by the Eastern Engineering Co., 45 Fox St., New Haven, Conn., for a new air-powered mixer announced by the company. The mixer employs a special high-torque, slow-speed air motor, and is intended particularly for heavy mixing. The motor is completely inclosed and can operate at varying speeds. The mixer is of the portable batch type, rated at 1½ hp., with a maximum speed of 400 r.p.m. at 40-lb. air pressure. A 12-in. diameter nickel-plated bronze propeller is provided, mounted on a stainless steel shaft.

New Grinders

DETAILS of a new series of grinders introduced under the designation of Prater Advance Series have been announced by the Prater Pulverizer Co., 1825 South 55th Ave., Chicago, Ill. Four sizes, for 30 to 75 hp. motors, are included, adapted to the grinding of a wide variety of materials. The grinders incorporate what is described as an advanced type of air-separation design. Material first enters a built-in crusher-feeder, where it is reduced in size and fed to the final grinding elements in a uniform flow. Issuing from the crusher feeder, the material passes through a baffled air stream to remove foreign matter such as tramp iron, discharging to the crusher section of the final grinding process. It then passes directly under a number of small, heavy, closely spaced crusher elements, operating close to the surface of the first grinding drum. From here, under a combination of the force of the crushers and the following flow of air, the material passes into the swing-hammer section, where it is carried across the course of the hammers, and against the face of the screen. The force of the incoming air, added to the air pressure generated by the revolving blades on the rotor, is exerted to remove all material through the screen as it is ground to size. Owing to the fact that the hammers operate close to the screen surface, all unground material is said to be carried off at each revolution.

Automatic Coal Scale

AN IMPROVED LINE of automatic scales for weighing coal in steam boiler plants and elsewhere has been developed by Stock Engineering Co., West 98th St. and Theodore Ave., Cleveland, Ohio. The scale is of the inclosed type, having an endless feed belt discharging into a scale-balanced weight hopper made of 13 percent chrome stainless steel. The gate mechanism on the hopper, which discharges the coal when the hopper has been filled, is said to be especially dependable. An easily operated bypass is provided for bypassing the scale in the event of electrical failure. Scales are built in two sizes, one with a 200-lb. and one with a 400-lb. hopper.

Hydraulic Packer

BUILT PRIMARILY for packing light, fluffy materials into containers is a new hydraulic jolter, or packer, recently put on the market by the Syntron Co., 610 Lexington Ave., Homer City, Pa. The jolter is made up of a plate, on which the barrel, drum or other container to be filled is placed. A hydraulically operated cylinder lifts the table and drops it with a sharp jolt about once a second. However, both the speed of jolting and the overall lift can be controlled by a hand valve in the water line. If water at a pressure of 50 lb. is available, this suffices. Where lower pressures only are available a small electric motor-driven pump with a closed circuit can be supplied. Very little water is required, according to the manufacturer.

New Developments

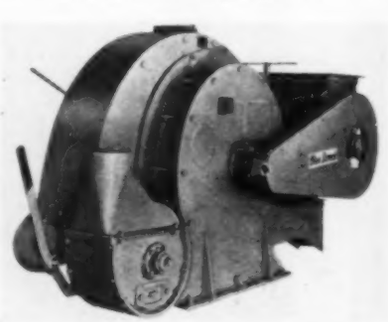
FOR INDUSTRIAL use, a new 230-volt Multi-Breaker has been announced by Cutler-Hammer, Inc., 315 North 12th St., Milwaukee, Wis. The cost is said to be a little more than that of a Type A switch. The new breaker is used as a motor circuit switch or service disconnect switch. It is fuseless, with bimetallic strip actuation, visible trip indication and a trip-free lever. Its rated capacity at 230 volts is 15 to 100 amp. and it is available in three-pole, three-pole solid neutral, and four-pole solid neutral types. The breaker is completely inclosed and semi-dust-tight.

DISTRIBUTED by R. P. Cargille, 118 Liberty St., New York, and manufactured by Micro Essential Laboratories, Brooklyn, N. Y., is a new dispenser for Hydrion pH test papers. Although this dispenser is of "vest-pocket" size, it holds two 15-ft. rolls of test paper. The container need not be opened. The strip is merely pulled out and torn off at the length needed. Refills are available. An accuracy within 0.5 pH unit is claimed.

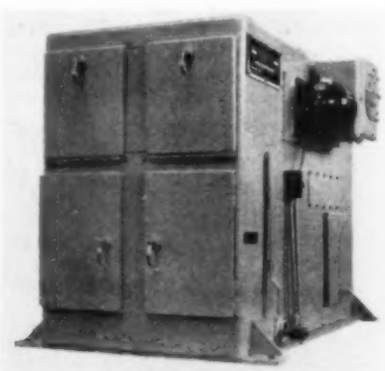
WILSON WELDER & METALS CO., 60 East 42d St., New York, N. Y., has announced Model TW, a new line of alternating current transformer welders in 300, 500, 750 and 1,000 amp. capacities. These are self-contained units for operation on 220, 440, or 550 volts, 25- or 60-cycle current. All units are stated to have an electrical efficiency of about 80 to 85 per cent. They have a wide range of current output and continuous stepless current regulation over the entire range, provided by use of a hand-crank on top of the machine.

Air-powered mixer

New Advance Series grinder

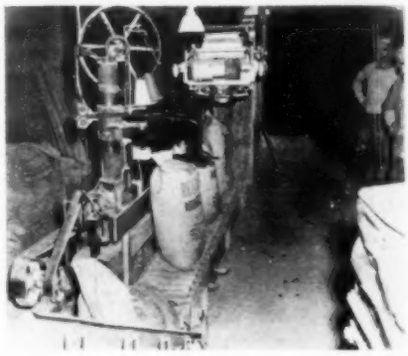


New 200-lb. coal scale



Hydraulically operated packer

Solvent stripper for vacuum pumps



Applying Rip-Cord Closure to fertilizer bag

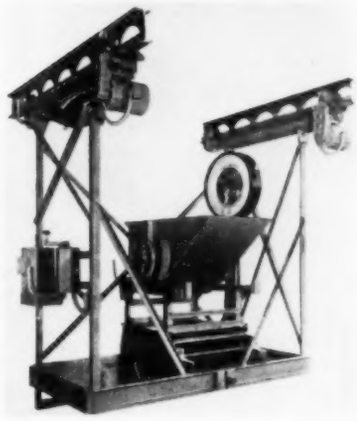
Solvent Stripper

DESIGNED FOR USE as an auxiliary to its oil-sealed vacuum pumps for certain types of application is a new steam-distillation solvent vaporizer recently announced by F. J. Stokes Machine Co., Olney P. O., Philadelphia, Pa. The unit is not a substitute for the oil clarifier supplied with this company's pumps, but rather is used as an additional auxiliary under special circumstances to remove low-boiling solvents and other volatile compounds from the pump sealing oil. Use of this unit is said to make it possible for the pump to maintain extremely high vacuum in solvent applications, within a few millimeters of absolute, without dilution of the oil. Practical elimination of pump shutdowns for oil changes is said to result. The solvent may be recovered if desired.

Improved Acid Pumps

SEVERAL improvements in its Olivite acid-handling centrifugal pumps have been completed recently by Oliver United Filters, Inc., 33 West 42d St., New York, N. Y. A new design of impeller, a resilient sleeve, a split gland and lantern ring are all made of a high tensile plastic. Use of this material is said to have permitted a change in design resulting in a 20-25 percent increase in efficiency and up to 5 percent increase in discharge head. Owing to a reduction of about 50 percent in

Improved Olivite pump



Traveling bach-scale car

impeller weight, the over-hung load is decreased, thus reducing torque on the shaft and increasing the stuffing box life. The new high tensile plastic is employed at present only in the company's 2-in. size pumps.

Rip-Cord Closure

A NEW METHOD of closing cloth and jute bags, known as the Rip-Cord Closure, has been developed by the Bag Closure Corp., 70 South Main St., Nazareth, Pa. This closure is applied to the bag by sewing a specially designed cord across the face of the bag, adjacent and parallel to the edge of the mouth. A paper strip of about 1-in. width may be sewn to the bag at the same time. This strip may be printed if desired for identifying the contents of the bag. It also assists in removing broken threads from the fabric of the bag when removing the closure. Overhanging ends of the rip-cord are left in closing, and either of these may be gripped firmly and pulled, breaking the stitches and opening the bag. It is claimed that bags so closed may be re-used repeatedly.

This method is applied to bags which are closed before filling, as well as to bags which are closed after filling. The high-speed assembly-line method of applying this closure to either filled or unfilled bags has been developed by Fidelity Machine Co., 3908 Frankford Ave., Philadelphia, under license. The sewing machine is manufactured by Union Special Machine Co., 402 North Franklin St., Chicago. Unfilled bags are fed into the sewing head on an automatic conveyor which is accurately synchronized with the speed of the sewing machine. Bags are automatically counted and the rip-cord automatically cut, allowing 3 to 5 in. to serve as a hand-pull for opening. Such bags are filled through a self-sealing flap at the bottom. When bags are to be closed after filling, they are fed through the sewing machine by means of a special conveyor.

Among other advantages claimed for this type of closure is the high speed of application. The closure, it is claimed, may be applied to over 1,000 bags per hour, while bags can be opened quickly and easily without tools. Partial opening forms a convenient pouring spout when needed.

Batch-Scale Car

SUITABILITY to the handling of batch materials entering into the manufacture of rubber and clay products, chemicals and a wide variety of other materials, is claimed for a new traveling batch-scale car developed by the Cleveland Tramrail Division of The Cleveland Crane & Engineering Co., Wickliffe, Ohio. The car is motor-driven and controlled by an operator who rides on the platform space provided to the left of the bucket. A variable speed drum controller permits the car to travel at any speed up to 300 ft. per min. Double overhead rails make it possible to straddle overhead bins, so that their chutes may be brought close to the car bucket. The unit is designed to gather exact amounts from various bins to make up a batch, an accurate scale on the car being provided to weight ingredients as they are dumped in. Discharge is readily accomplished by tilting the bucket through use of a crank wheel.

Equipment Briefs

TWO MODELS of photoelectric smoke indication and elimination equipment, for operation on 115-volt alternating or direct current, have been announced by Rehtron Corp., 2159 Magnolia Ave., Chicago, Ill. Model SC-301 is an indicating, signalling type, in which an illuminated density meter continuously indicates the smoke density in the breeching or stack, and operates a bell or light signal when the smoke exceeds the allowable density. Model SC-302 is an automatic control type, incorporating the features of the first mentioned model, plus automatic control for a solenoid valve or blower motor supplying steam and air to over-fire jets. An adjustable time-delay on the load circuit permits correct setting for individual boiler conditions.

A SIMPLE DEVICE for adding humidity to air for industrial use, as in the manufacture of explosives, has been introduced under the name of Warco

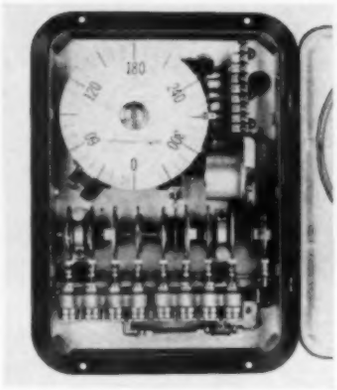
Moisturator by W. A. Russell & Co., Bridgeport, Conn. Installed on any steam line, the device is said to be able to evaporate as much as 2 gal. of water per hour from a single unit. Either manual or automatic control can be used. The device consists of a copper evaporator supplied by plant or heating steam, or from a separate steam generator. A thin film of water on the evaporating surface is maintained by a newly designed float valve which is said to furnish positive control. One unit, according to the manufacturer, can properly humidify a space of up to 12,000-18,000 cubic feet.

A NEW LINE of rotary pumps recently put on the market by the Blackmer Pump Co., Grand Rapids, Mich., is available in the range of capacities from 50 to 700 g.p.m., for pressures up to 150 lb. Standard units are furnished in either reduction gear drive, gear-head motor or V-belt drive. Standard constructions include all-iron, bronze-fitted, and all-bronze. These pumps employ the company's standard swinging vane principle, in a design intended especially for higher pressures. Internal roller bearings are used on pumps for lubricating liquids, while external roller bearings are furnished on pumps for handling non-lubricating liquids. The latter type is provided with a mechanical seal, thereby eliminating conventional stuffing boxes.

A PORTABLE dust collector of the centrifugal type, weighing 75 lb. and having a capacity of about 200 cu.ft. per min., has been announced by Bowen Research Corp., Garwood, N. J. The collector is provided with three legs pivoted at the top, to permit folding when the unit is carried from one location to another. The legs can be made to telescope to give any desired height. Dust collecting efficiency of the unit is stated to vary between 95 and 99 per cent.

SEVERAL new models of engine-powered generating units for portable or stationary service have been added to the line manufactured by Kato Engineering Co., 530 North Front St., Mankato, Minn. The new Model 23A unit employs a 1-hp., single-cylinder, air-cooled engine in producing 500 watts at 110 volts and 60 cycles. Three new 1,200 r.p.m. models are available for 5,000, 7,500 and 10,000 watts a.c. at 60 cycles. The engine and generator assembly is mounted on rubber, permitting installation without bolting down on foundations. Full automatic control can be furnished with the 5,000 watt size, while larger sizes are available only with remote control.

FOR USE wherever rotating equipment is used, in measuring rotating speed, feet per hour, gallons per minute, or other factors, a new alternating



Improved cycle controller

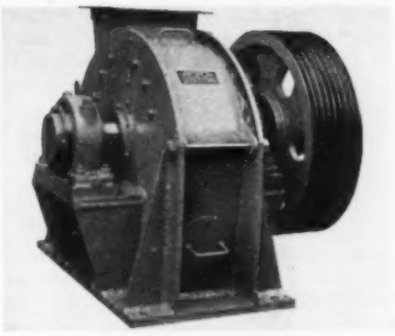
current tachometer recently announced by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., is available for rotative speeds from zero to 5,000 r.p.m. Known as Type A-80, the tachometer consists of an alternating current generator and a rectifier voltmeter. No brushes or commutator are used in the generator, which is of the permanent magnet, a.c. induction type. This alternating current is rectified by a Rectox unit in the voltmeter, which is calibrated in units required by the particular application.

Time Cycle Controller

TIMING CONTROL on tire molds and other plant processes where a number of factors must be accurately timed according to a fixed program is the function of a new multiple-cam time cycle controller, known as the Model A-118 Impulse-Sequence cycle controller, and manufactured by The Bristol Co., Waterbury, Conn. In this controller time measurements and pilot valve operation are handled by separate mechanisms, a feature said to improve accuracy, speed and flexibility of the unit. Timing is accomplished by a Telechron-driven aluminum disk on which is printed a 25-in. time scale. The desired schedule of operations is set up on the disk by punching holes on the time scale with an ordinary ticket punch. The location of these holes determines the time of operation of the cam mechanism. The cams used to operate the pilot valves are individually adjustable, and any number up to eight cams can be used. Instruments having less than eight cams can readily have the number increased to eight by the user.

Heavy Duty Knife Cutter

ADAPTABILITY to a wide range of materials where cutting action is required as a preliminary reduction step is claimed for the new heavy duty Type 1680 Super knife cutter recently announced by Sprout, Waldron & Co., Muncy, Pa. Among the substances handled are scrap rubber, plastics and similar materials. The cutter is equipped with a heavy cast-steel rotor 10 in.



Heavy duty knife cutter

Circuit interrupter for explosive atmospheres

wide, mounted on a 4¼ in. shaft, the latter carried on heavy duty roller bearings equipped with dust and grease seals. Heavy construction is employed, the base being of 1 in. plate and the side plates of ¾-in. steel. The top section is hinged to permit ready opening for changing screens and adjusting knives. Five ¾-in.-thick knives on the rotor, and three 1-in.-thick stationary knives are employed. The screen is of ⅜-in. perforated steel. In a recent installation operating on running board scrap, a capacity of 800-1,000 lb. per hour was obtained with a 7/16-in. screen, using an average of 25 hp.

Explosion-Proof Interrupter

DESIGNED for use in explosive atmospheres, for disconnecting or interrupting alternating or direct current circuits, is a new non-automatic circuit interrupter, recently announced by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Meeting Underwriters' specifications for Class 1, Group D hazardous locations, the interrupter is furnished in a NEMA type 7 cast inclosure with closely ground fit between box and cover. Resistance to explosive pressures is assured by heavy walls and strong fastenings. The interrupter is designed for 250-600 volts on a.c. circuits, 125-250 volts on d.c. circuits, for 50 to 600 amp., and with an interrupting capacity of 5,000-10,000 amp. De-ion arc quenchers and silver or special silver composition non-welding contacts are used.

FACTS YOU NEED TO KNOW ABOUT . . .

Rotating-Leaf Pressure Filters

For liquids containing relatively small percentages of suspended solids that are colloidal or semi-colloidal in nature.

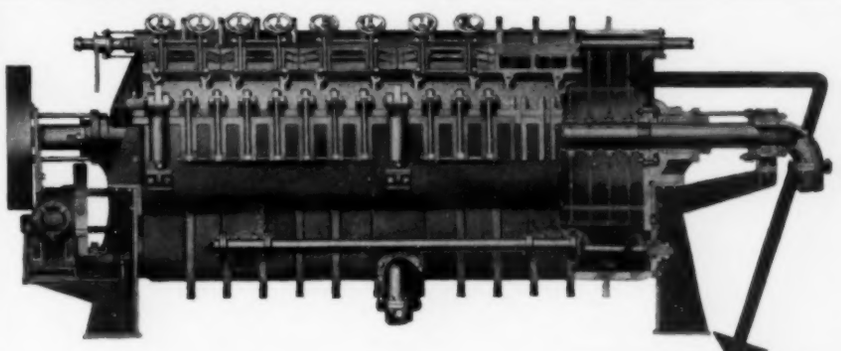
ADVANTAGES

Rotating-leaf pressure filters are high capacity units which are particularly adaptable to the filtration of liquids containing extremely slow-settling solids. Cake formation is exceptionally uniform, cost of operation is low, washing efficiency is high, and closed cycle operation assures less contamination and maximum safety.

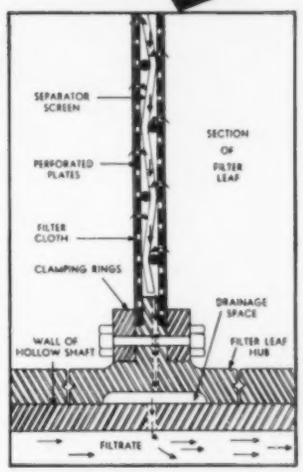
All leaf surfaces rotate. Consequently, cake formation is uniform regardless of variations in density of the liquid. Thus, more solids can be deposited before "bridging" the leaves. Application of the proper precoat provides a perfectly clear, polished filtrate. Less filter-aid is required. The closed cycle eliminates danger from corrosive and volatile liquids.

LIMITATIONS

While the rotating-leaf pressure filter is ideal for fine filtration, giving a polished filtrate, other types of filters will be more adaptable and lower in overall cost where the primary objectives are the filtration of coarse particles or continuous rather than batch operation.



PRINCIPLE OF OPERATION



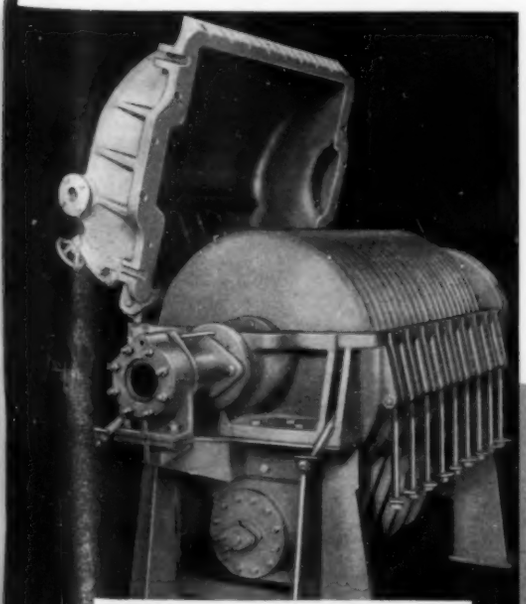
Liquor is fed under pressure into the filter casing. As pressure forces liquor through the filter cloth and into the interior of each filter leaf, cake forms on the leaf. The filtrate passes to the center of the hollow shaft from which it is discharged. The feed is shut off when a predetermined pressure in the filter body is reached, and the remaining liquor is drained back to the supply tank. The cake may be further dewatered and dried by blowing air or steam through it. The cake is dislodged by air or sluicing and discharged by a screw conveyor at the bottom of the unit.

CONSTRUCTION

The Swenson rotating-leaf pressure filter consists of a horizontal cylindrical shell containing circular leaves mounted at right angles on a central hollow shaft. The housing is made in halves. The top half, normally closed with hinged bolts, may be raised for access to the filter. Each filter leaf consists of a disc-shaped drainage screen covered on both sides with perforated plates and wire cloth. A channel for the filtrate is provided between the leaves and hollow shaft. A spray pipe inside, at the top, is used for dislodging the cake by sluicing.

APPLICATIONS

Typical applications of the Swenson rotating-leaf pressure filter are found in the filtration of sugar liquor and syrup, oils and volatile solvents, and 50% caustic soda. Savings in filter-aid, low maintenance, and uniformity of the product have made this type of filter practically standard. With oils and volatile solvents, a drier cake and the closed cycle of operation are particularly advantageous. The cake may be discharged without opening the filter. Fire hazard is reduced. With 50% caustic soda, salt precoating and relatively open cloth are used.



Swenson rotating-leaf pressure filter showing filter leaves.

SWENSON EVAPORATOR COMPANY

Division of Whiting Corporation • *15669 Lathrop Ave., Harvey, Ill.*

SWENSON

CRYSTALLIZERS

FILTERS • EVAPORATORS

Solvent Dewaxing of Lubricants

THE SOLVENT DEWAXING PROCESS has been developed in recent years and is now generally employed in the manufacture of high grade lubricating oils to remove wax from the oils and thereby lower the pour test. A mixture of two solvents is generally employed in the process. One solvent, for example, methylethylketone, in which wax is substantially insoluble, enables the wax to be crystallized at reduced temperatures in a highly filterable form. The other solvent, for example, benzol, is one in which the oily portion of the hydrocarbon is highly soluble at reduced temperatures.

The first commercial installation of the process was made by the Indian Refining Co. at Lawrenceville, Ill., about 1928. It was the only installation of its kind for about five years. The process was jointly developed with The Texas Co., and licensed to other refiners, beginning with 1933. Since that time a total world wide capacity of about 40,000 bbl. of lubricating oil charge per day has been installed.

The dewaxing process installation requires a limited amount of attention to operate and maximum use is made of automatic controls. Solvent losses are extremely low averaging 0.05 percent by volume of the solvent circulated. Fire and explosion hazard is reduced to a minimum by use of an inert gas system.

The process is used to dewax either distillates or residual stocks from a wide variety of crude petroleum sources. Either raw or highly refined oils may be dewaxed and the wax content of the stock has little influence on the quality of the products. Waxes produced are low in oil content and dewaxed oils are free of wax haze.

CHEMICAL & METALLURGICAL ENGINEERING

October, 1941

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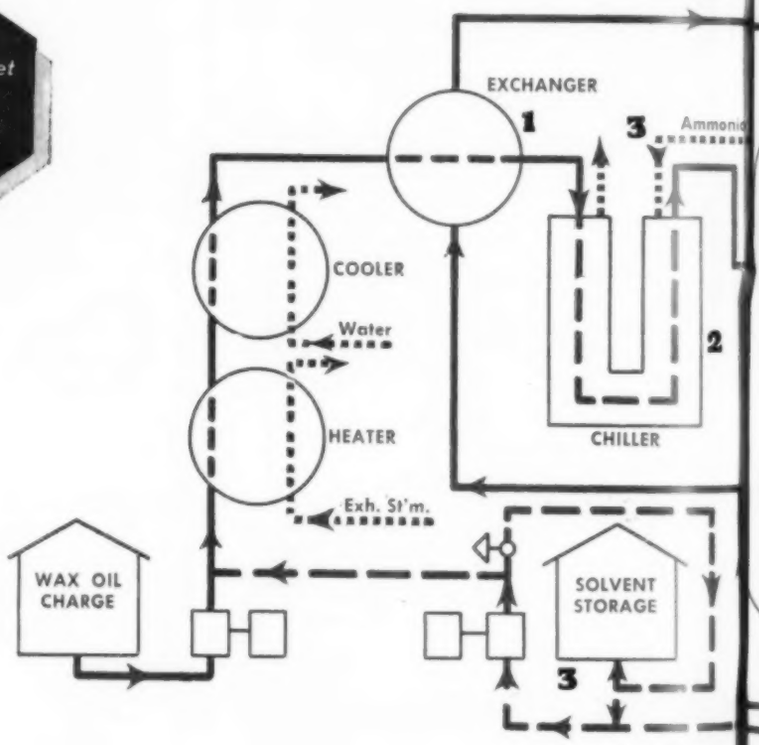
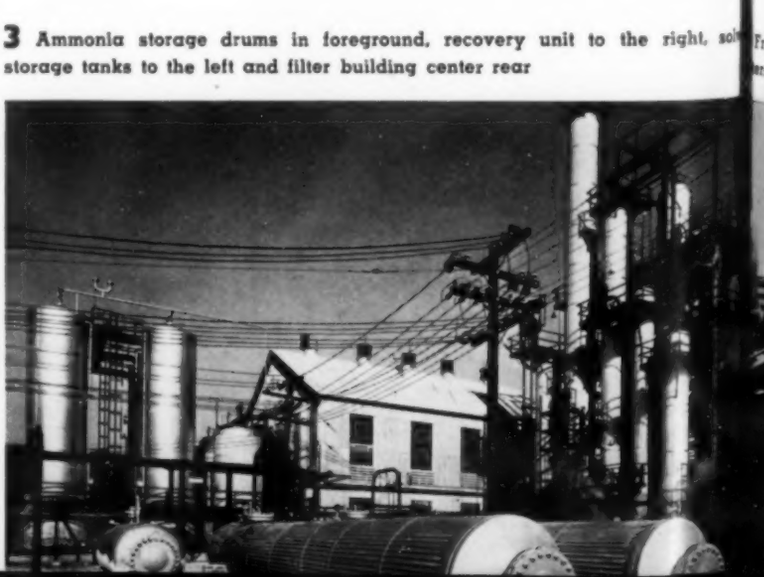
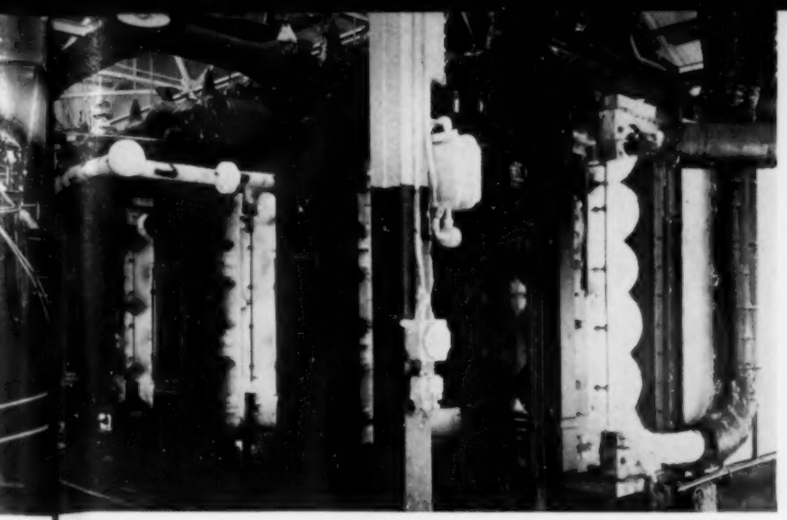
1 Drive end of heat exchangers. Exchange between wax mix charge and double pipe dewaxed solution gives high refrigeration recovery

A *Chem & Met* FLOW SHEET

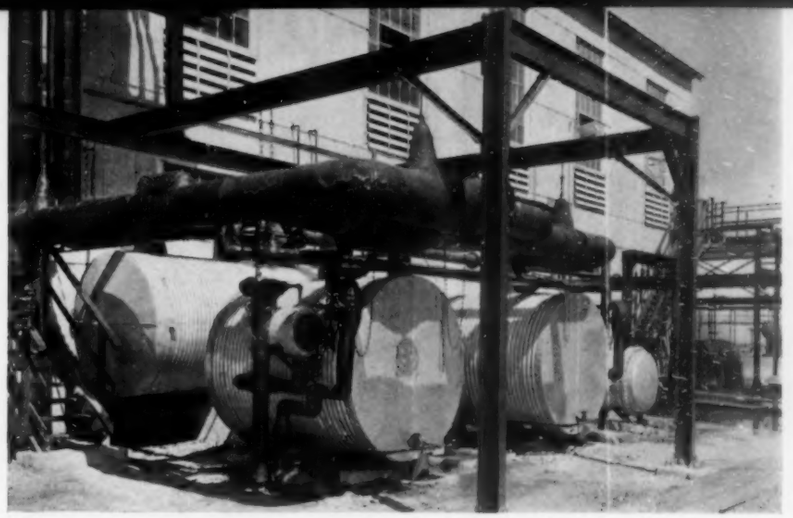


3 Ammonia storage drums in foreground, recovery unit to the right, solvent storage tanks to the left and filter building center rear



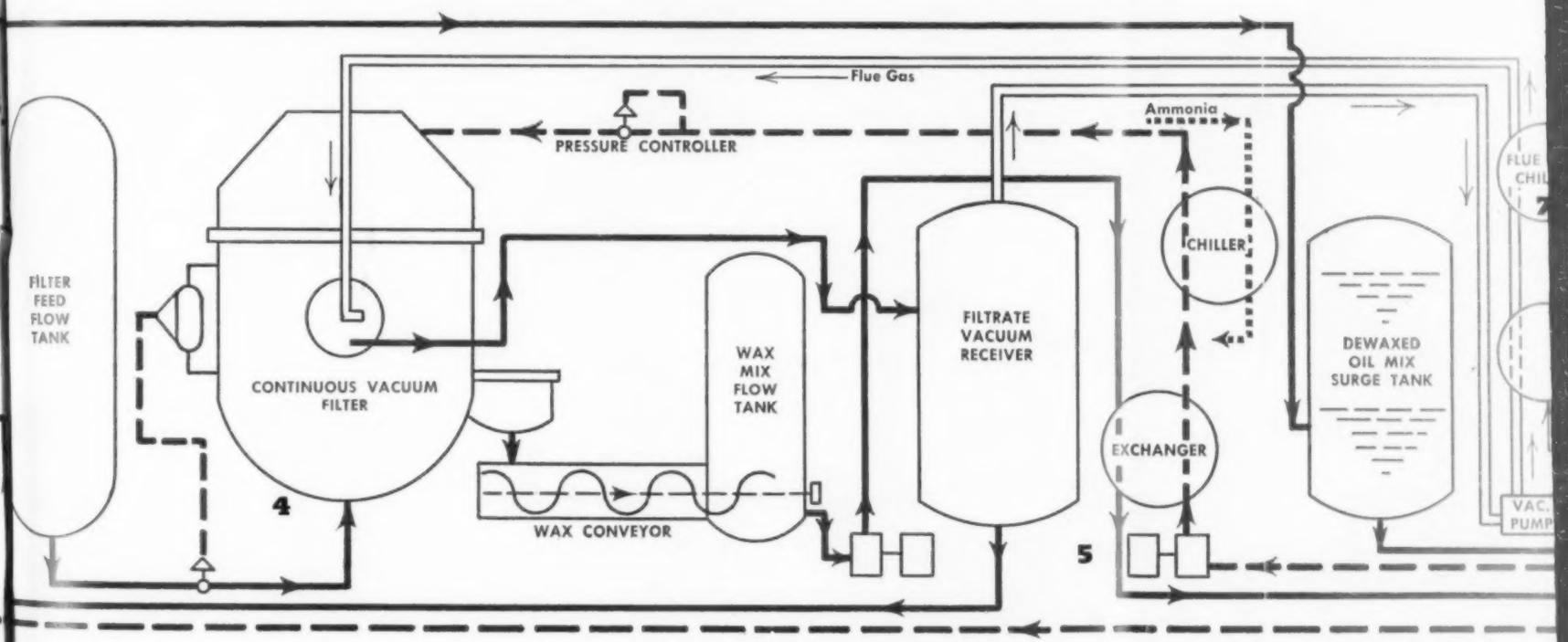


arge ouble pipe coil ammonia chilling units. Chilling from approximately 0 deg. F. 0 deg. F. by direct ammonia expansion



7 Flue gas chillers (front) and flue gas receiver (rear). Two flue gas chillers are used, equipped with reverse flow mechanism, to prevent icing

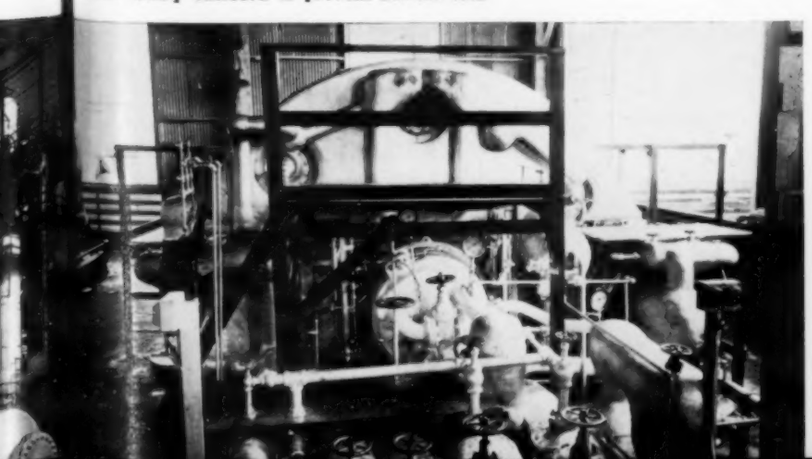
8 Flue tanks are

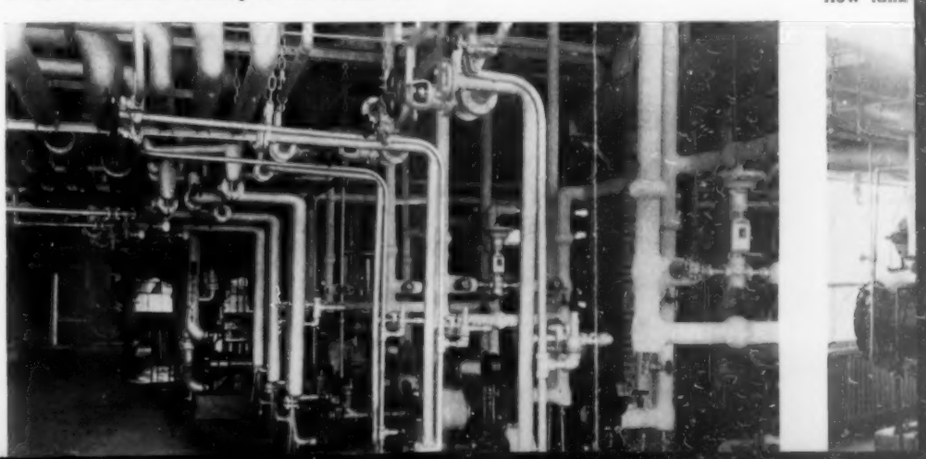


Front view of a continuous vacuum dewaxing filter showing control manifold. rs are totally enclosed to prevent solvent loss

5 Solvent dewaxing unit pump house for filtration and solvent recovery units of the Port Arthur refinery of the Texas Co.

6 Vacuu flow tank





ıe gas chillers
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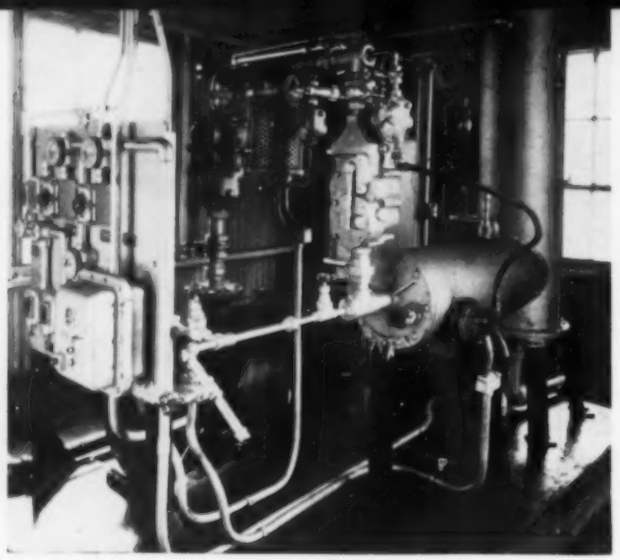
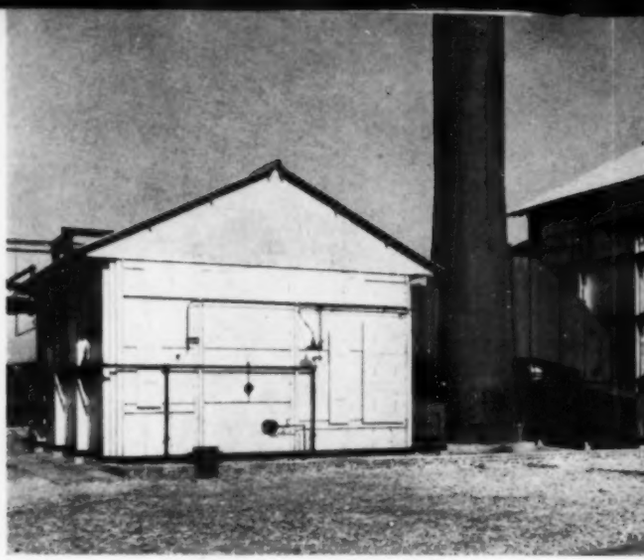
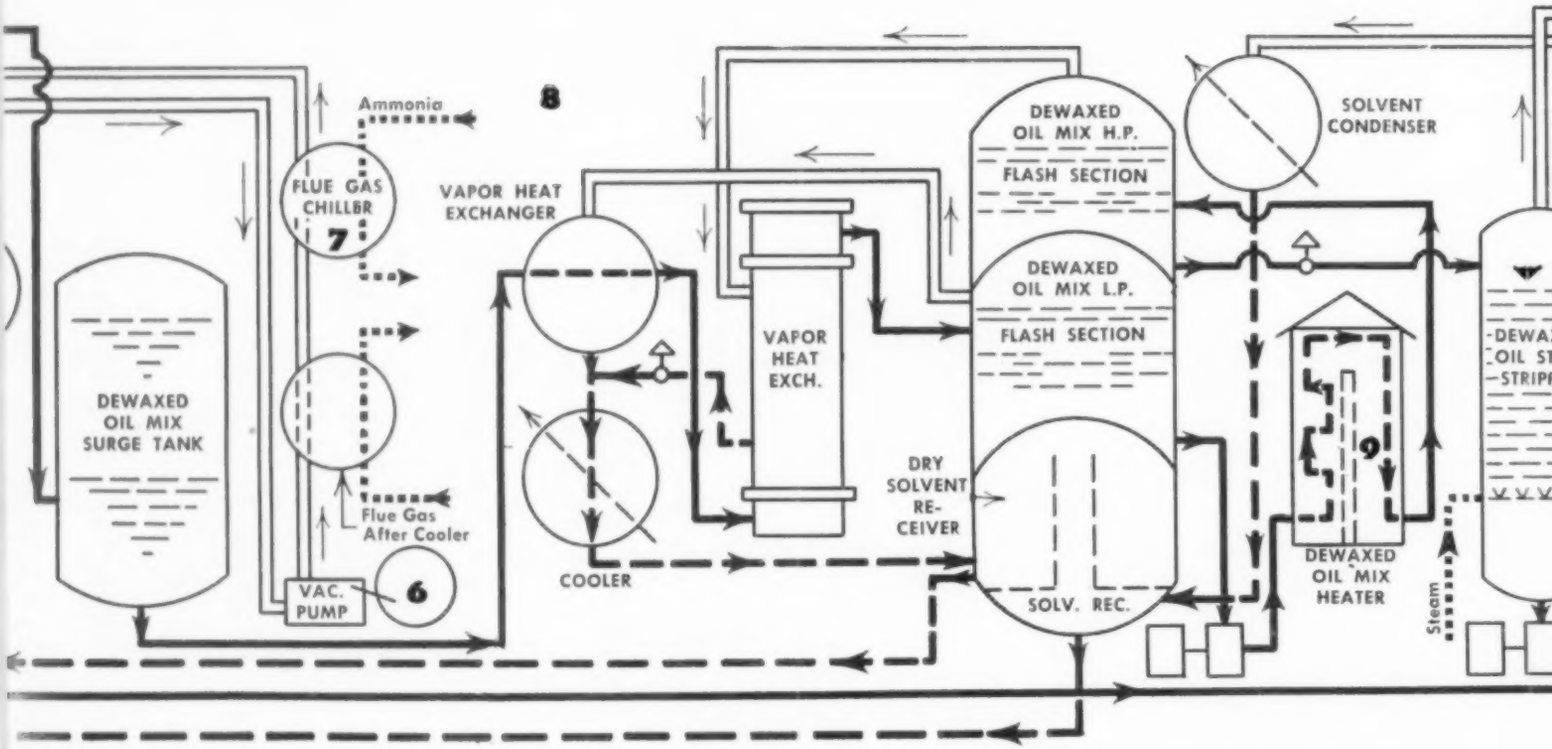


8 Flue gas generating equipment. Filter and storage tanks are blanketed with flue gas to reduce solvent losses



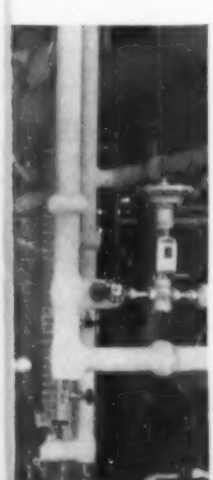
9 Slack wax and dewaxed oil gas fired heaters. Slack wax h
heater to the right

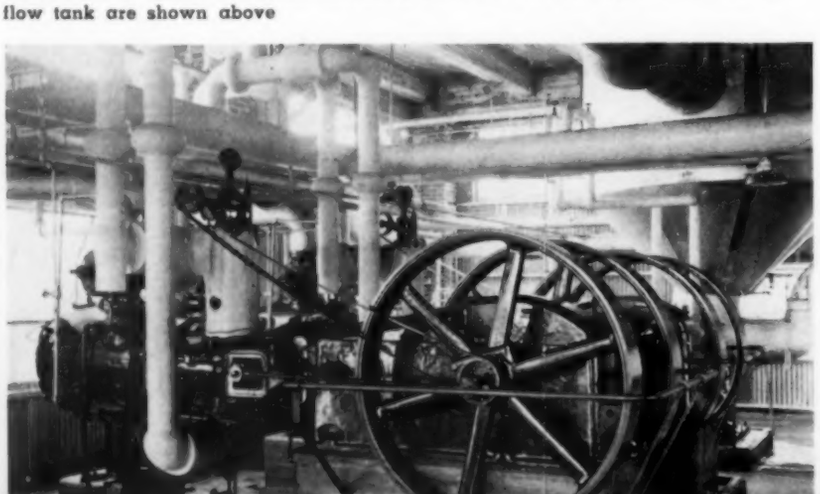


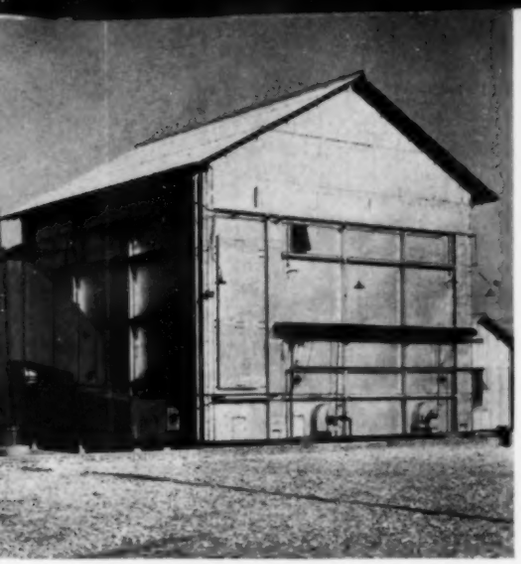
recovery units

6 Vacuum pumps for vacuum dewaxing filters. Wax conveyor and wax mix flow tank are shown above

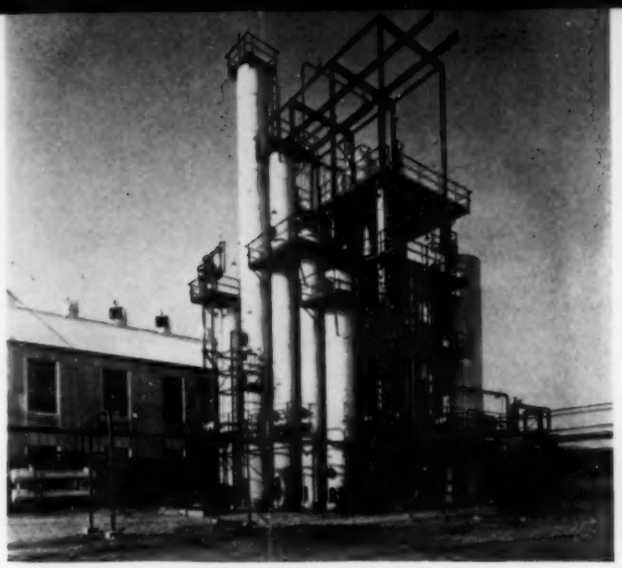
11 General view of solvent dewaxing unit
the center, solvent recovery unit to the left



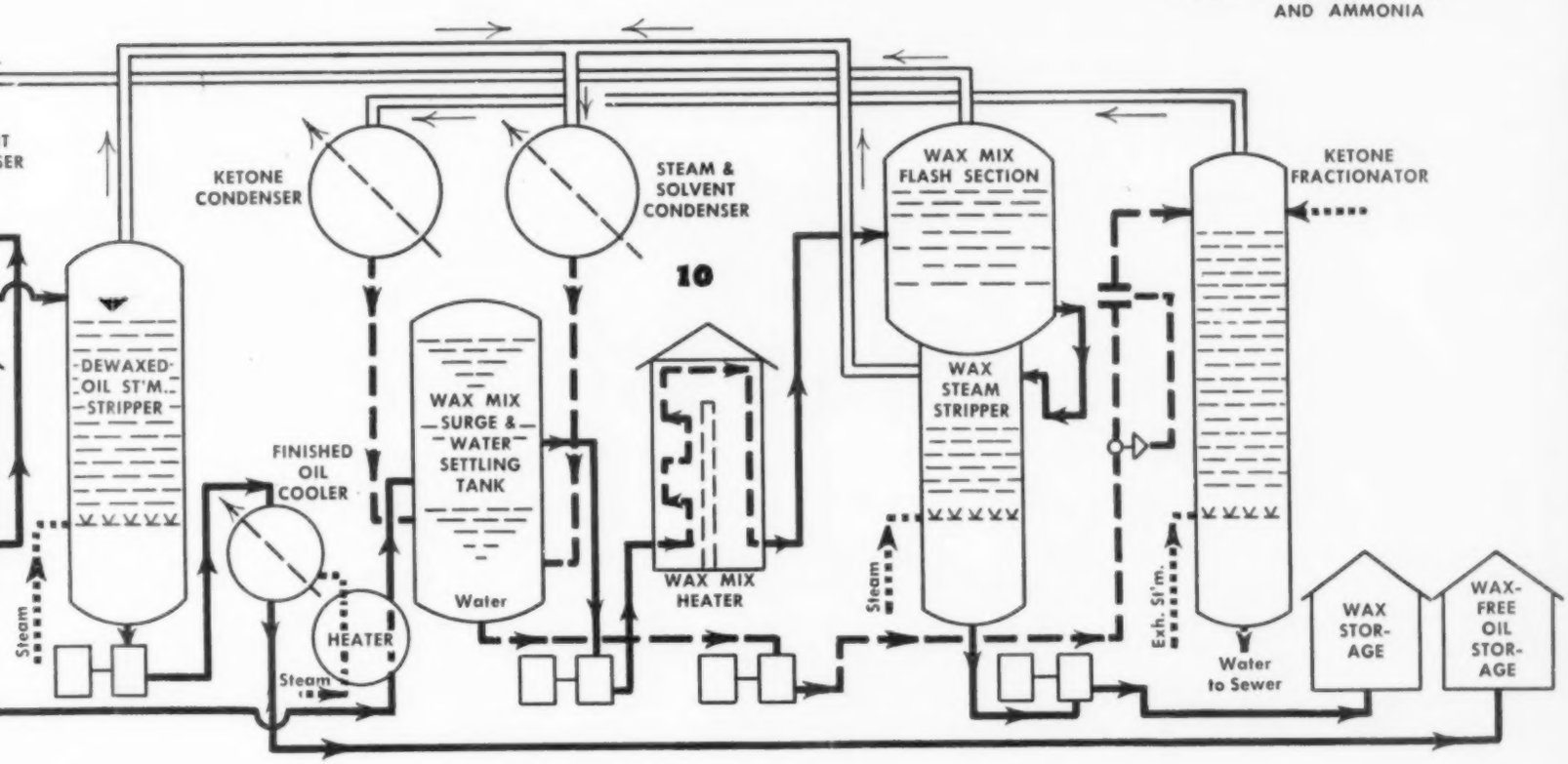




Slack wax heater to the left and dewaxed oil

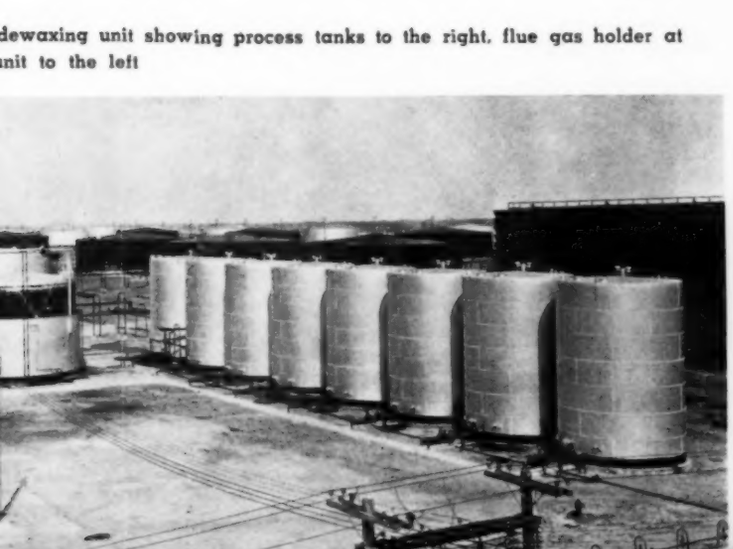


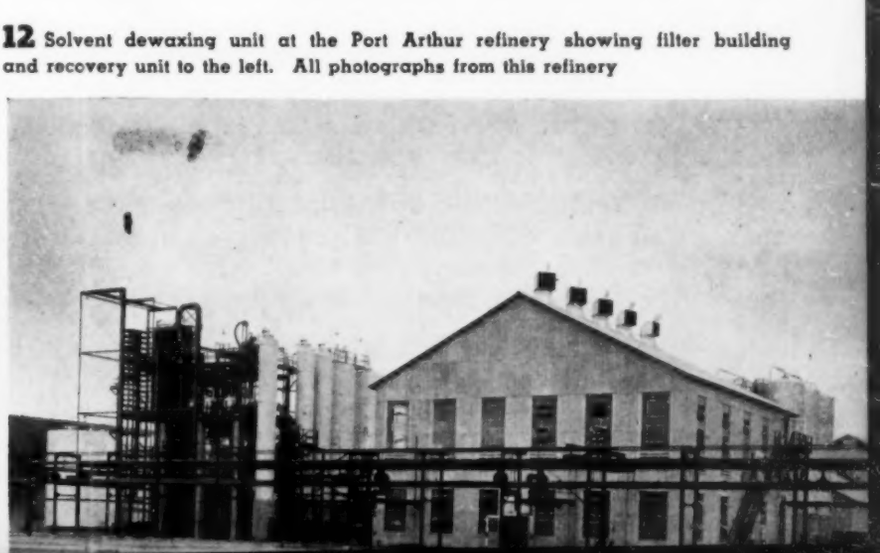
10 Solvent recovery unit showing dehydrator, slack wax surge, dewaxed oil stripper, methylethylketone fractionator



dewaxing unit showing process tanks to the right, flue gas holder at unit to the left

12 Solvent dewaxing unit at the Port Arthur refinery showing filter building and recovery unit to the left. All photographs from this refinery





BETTER CALL IN A SPECIALIST!

The old-time doctor had his bottle of pink pills that were a panacea for every ill. But he often failed to meet the demand of the emergency and he has had to give way to the specialists.

There was also a time when general manufacturers were the only doctors of corrosion and prescribed the metals or equipment they made. And corrosion took a terrific toll from industry.

But combating corrosion has become a specialized business. The Duriron Company, for instance, furnishes equipment in ten different corrosion-resistant alloys. We have developed new metals to handle the numerous chemicals which have become so important in manufacturing processes. Only the Duriron Company has available alloys that cover such a *wide* range of corrosives from which to choose in meeting any specific acid-handling problem.

And in the best tradition of industrial cooperation, our metallurgists and engineers . . . with their years of specialized experience to guide them . . . are ready to work with you in the application of Durco Alloys to the particular equipment your processes require.

In the rush of building for the present, it is well to keep an eye on the future. Let our specialists help you plan your acid-handling equipment.

THE DURIRON COMPANY, INC.

DAYTON, OHIO

HELPFUL HINTS ON CHOOSING VALVES FOR BETTER PIPING SERVICE
PLEASE CHECK AND PASS ON
POST ON SHOP BULLETIN BOARD
AN AID TO DEFENSE
No. 3 of a series of bulletins designed to help industrial maintenance men keep piping systems working at peak efficiency. Issued by Crane Co.; distributed by Crane Representatives.

Shop Bulletin No. 1 gives hints on handling valves and fittings; No. 2 shows pointers on piping placement. Ask your Crane Representative to explain how you can get valuable aid from this practical service.

Ready for you...

CRANE SHOP BULLETIN NO. 3

It's ready—to help you keep pipe lines in peak condition for peak production—to help you get maximum service from present equipment. This timely Crane Shop Bulletin Service is designed to aid you in training new maintenance men; and to caution experienced workers on piping fundamentals often overlooked with costly results. Bulletin No. 3 gives many valuable hints on the proper selection and usage of valves. Copies for distribution to your piping crews may be had from your Crane Representative—or by writing to us.

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VALVES • FITTINGS • PIPE
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NATION-WIDE SERVICE THROUGH BRANCHES AND WHOLESALERS IN ALL MARKETS

How you can increase Mill Capacity by 25% to 75%

WHIZZER SEPARATORS

are furnished as standard equipment on the latest type of Raymond Roller Mills, Automatic Pulverizers, and Imp Mills. Available with single or double set of whizzers, depending upon the requirements of the material to be classified.

. . . simply equip your Raymond Roller Mill installation with the modern Whizzer Separator.

No need for plant alterations or any disrupting of production schedules.

It is made to fit in place of the old classifier, and the revolving whizzer blades are motor-driven through a variable speed control unit.

Changing the whizzer speed regulates the fineness, giving a wide range of classification from 60% minus 100-mesh to 99.75% passing 325-mesh, adjustable while the mill is running.

Result: Greatly increased output . . . more uniform finished material . . . and closer control over the product.

SINCE 1887

The RAYMOND Whizzer-type Roller Mill

is used with great success in scores of plants for reducing raw materials to powdered form in making various chemicals . . . for pigment grinding . . . and for drying and pulverizing many different finished products.

The typical installation, shown at the right, is operated with a drying system for the removal of moisture in grinding clay for the preparation of fillers used in the paint, paper and rubber industries.

Other applications include: Pulverizing phosphate rock and bentonitic clay with resultant increases in capacity of 35% to 50% . . . reducing talc and soapstone to classify 99% through 200-mesh . . . making superfine insecticides for spraying . . . grinding sulphur, resins and chemicals.

Tell us your problem . . .
Bulletin sent on request

RAYMOND PULVERIZER DIVISION
COMBUSTION ENGINEERING COMPANY, INC.
1311 North Branch Street CHICAGO
Sales Offices in Principal Cities • • • In Canada: Combustion Engineering Corporation, Ltd., Montreal

Technical, Industrial, Personal

MORE THAN THREE HUNDRED EXHIBITS ARRANGED FOR CHEMICAL SHOW

Technical problems created by the program of national defense will make the 18th Exposition of Chemical Industries, in Grand Central Palace, New York, December 1-6, an event of greater importance than any in the long line preceding it. Until now comparatively scant attention has been paid to the persistent and thorough infiltration of chemical products and chemical processes into American industrial life. Now it is being discovered that their applications are almost universal. Developments in the present emergency are rapidly disclosing, by sharp contrast, a succession of new products that are not only independent of foreign sources, but also independent of many of the preconceived natural resources.

Timed at this critical juncture, more than 300 exhibits, representing the highest concentrate of industrial ingenuity, are now being prepared to be assembled from all parts of the country and compacted into more than three acres of floor space, under a single roof, in Grand Central Palace.

Comprising a highly selective, technically-minded audience, this gathering will study the working principles of new processes and equipment, learn through exhibits and discussions of new applications recently made, and newer ones even now being completed, and they will consult with specialists in many different lines their plans for future applications.

ENGINEERING DEFENSE BOARD SET UP BY NATIONAL SOCIETIES

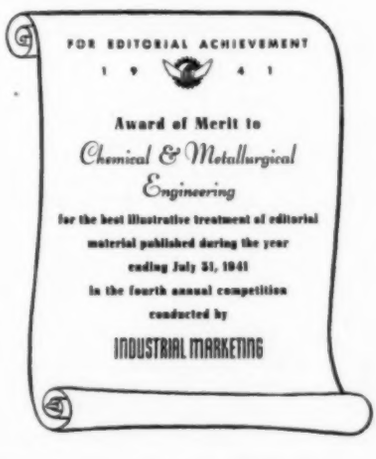
Establishment of the Engineers Defense Board, a new working organization of engineers and technologists from the several national engineering societies to deal with technical problems on shortages, substitutions, conservation, raw materials, production and reclamation in the nation-wide adjustment under the impact of the defense effort, has been announced.

With an initial membership of five representatives each appointed by the governing bodies of the American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, the Society of Automotive Engineers, and the American Institute of Chemical Engineers, the new organization will assist the various branches of government with engineering knowledge and experience on questions connected with military preparedness.

The Board will function as a clearing house for the engineering professions on information dealing with defense, particularly in relation to shortages, and through special committees will attempt improvements of standards and practices of long standing where savings of materials can be made. In many instances it is expected that the results will produce lasting benefit to the public as well as an immediate aid to defense. The Board also will take an interest in methods for implementing the work of the advisory technical committees of the National Academy of Science and will undertake specific studies on request of the Army, Navy and official defense agencies.

Representatives from the American Institute of Chemical Engineers are: F. W. Willard, president, Nassau Smelting & Refining Co., executive committee representative; Webster Jones, Carnegie Institute of Technology; R. L. Murray, vice-president, Hooker Electrochemical Co.; A. J. Weith, manager of research, Bakelite Corp.; R. E. Wilson, president, Pan American Petroleum Transport Co.

Serving as officers of the Engineers' Defense Board are Robert E. McConnell, OPM Consultant, chairman; Dr. Harry Rogers, president of Brooklyn Polytechnic Institute, vice-chairman; and Dr. A. B. Parsons, secretary of the American Institute of Mining and Metallurgical Engineers, secretary.


FOR EDITORIAL ACHIEVEMENT
1 9 4 1
Award of Merit to
Chemical & Metallurgical Engineering
for the best illustrative treatment of editorial material published during the year ending July 31, 1941 in the fourth annual competition conducted by
INDUSTRIAL MARKETING

CHEMICAL SECTION PERSONNEL OF PRICE ADMINISTRATION

Under the direction of Dr. T. J. Kreps, Consultant, the staffing of the Price Administration chemical section has been well started. O. B. Helfrich will be chief of the solvents unit; the compressed gases unit will be under the direction of John Boyer; T. E. Milliman is to be chief of the fertilizers unit; J. F. Corwin, chief of the plastics and resins unit; Frank Delgado and Robert P. Wright, fine chemicals unit; and Laurent LaBrie, chief of the miscellaneous chemicals unit. Acting chiefs of three units are Bernard Davis, inorganic acids; Gus D. Goldberg, with coating materials; and E. E. Wynkoop, with coal tar chemicals. Not yet appointed is the chief of the alkalis unit.

James A. Ross, chief of the chemical economics unit of OPA's chemical section, was announced also as deputy chief of the chemical section, effective October 4, when Dr. Kreps was to return to California to resume his teaching. Dr. Ross is on leave from his position as Professor of Economics at Syracuse University.

Lawrence Brown, chief of the chemical section of OPM's civilian supply division, is also advisor to the OPA chemical section chief.

OPM Materials Division chemical personnel not included in last month's list (*Chem & Met.* Sept. 1941, p. 135) are W. G. Whitman, chief of the toluol unit; W. A. Nyland, chief of naval stores unit; Frank H. Carman, chief of synthetic rubber section; G. J. Cox, chief of military requirements and progress section; and Warren S. Adams II, legal counsel.

SECONDARY POWER RATE ELIMINATED

Wholesale rates for electric power from the Bonneville-Grand Coulee Federal Transmission System have been revised since the 1938 schedule to eliminate the secondary power quotation of $9.50 per kw. yr. as reported on Page 82 of *Chem. & Met.* for September. The Bonneville Power Administration's revised schedule provides (1) A $14.50 per kw. yr. rate within 15 mile radius of powerhouse; (2) a $17.50 per kw. yr. rate elsewhere on the extensive transmission system which was shown in Fig. 2 on Page 80 of *Chem. & Met.*'s report on "Progress and Trends in Western Process Industries."

INSECTICIDE ACT REGULATIONS SLIGHTLY MODIFIED

The Agricultural Marketing Service has been responsible for enforcing the Insecticide Act since Food and Drug Administration was transferred from the Department of Agriculture to the Federal Security Agency last year. This has necessitated a few minor modifications in Insecticide Act regulations, which were published in the Federal Register of September 25.

News from Washington

WASHINGTON NEWS BUREAU, McGRAW-HILL PUBLISHING CO.

DELAY in perfecting contracts for chemical and electro-chemical plants is causing serious controversy in Washington. As October opened there were recrimination and controversy regarding the cause of what appears to be inexcusable delay in closing contracts, selection of sites, and otherwise completing arrangements for fundamental chemical enterprise.

Perhaps typical of the controversies was the attack on Administrator Jesse Jones for failing to complete magnesium contracts and aluminum contracts for months after specific recommendations were made to RFC by defense officials. Actually some contract arrangements that were announced months before had never reached the stage of final negotiations regarding major terms of agreement between government and industry. Various causes of delay existed. Among these, most important have been shortage of power, difficulty in plant site selection, and controversy over either reform or political considerations which might be influential now or later.

Some companies which have been conducting negotiations intermittently for six months or more with respect to possible ammonia plants reported at the end of September that they had no idea whether they ever would be able to reach any understanding with the government. In some of these cases tentative understandings have been reached only to be abandoned entirely through some change in the policy of negotiators. The result has been complete discouragement in some of the companies and a flat refusal to have anything more to do with these projects by others.

Why Estimates Grow

Considerable difficulty has been caused in many divisions of chemical enterprise because it has been impossible to determine how great the government demand will be for certain commodities. There have been several important factors entering, all of which resulted in constantly increasing the "official" estimates of requirement.

In the first place, the magnitude of American effort has grown. The share of the European and Oriental job assumed by Uncle Sam is constantly greater. A higher ratio of materiel to manpower has constantly been imposed on the planners. And finally, probably most important, there has been a willingness in official Washington to increase plans often without any study of industrial consequence.

The ammonia program which has been reviewed in these columns on several occasions is an outstanding example of multiplication of requirements. Perhaps more serious in immediate consequence has been the constant imposition of new demands for alcohol and methanol, which threatened to leave the motor cars of America without anti-freeze this winter.

Now it is officially announced that SPAB, under Executive Director Donald Nelson, will prepare final and governing estimates of requirements. This is undoubtedly the present program, but whether any one set of estimates can be imposed on all subsidiary defense activities later remains a very uncertain matter. Washington believes, therefore, that the greatest service which Mr. Nelson's organization can render will be certain willingness to decide questions with finality, refereeing controversies between conflicting organizations. Mr. Nelson has the disposition to do that, and the ability. But whether he has the President's authority to do so, was not yet obvious at the beginning of October.

Who Boosted Prices?

Price control measures have not progressed very much in Congress during August and September. It was recognized at the Capitol that a bill giving the President such authority would simply mechanize Leon Henderson's program of price ceilings. This was not within the range of the desires of most members of Congress, who do not take kindly to the OPA Chief's philosophy.

Second, more fundamental, obstacle was found in the fact that any price control measures seem bound to fail unless accompanied by authority to regulate agricultural commodities and wages. The political boomerang of such grant of authority was so obvious as to preclude serious consideration.

The likelihood of enactment of an effective price measure might have been greatly increased by the Brookings Institution report of late September, under ordinary circumstances. The findings of that impartial agency are accepted privately, it appears, throughout most of Washington. But publicly there are two parts of the finding which are loose quinine in the mouths of all political orators. One was the conclusion that the greatest advance in the cost of living through rising food prices was caused by the official attitude tending continuously to boost agriculture commodities. The second was the conclusion that the higher wage rates imposed on industry by the Mediation Board and other federal agencies would inevitably lead to higher goods cost generally.

Washington still believed early in October that prompt enactment of any price-control measure was highly improbable. If Mr. Henderson gets such an act by Christmas he will have every reason to be thankful to Santa Claus. And it is doubtful whether the act which may be delivered by the year-end will be sufficiently comprehensive to prevent a continued weakening of all price controls through ineffectiveness in control of both labor and agriculture.

Profiteers Prosecuted

The Justice Department announced during the latter part of September that it was taking into court for violation of anti-trust laws numerous marketers of chemicals who appeared to be "priority profiteers." It was pointed out, however, that practically all of the offending concerns charged with law violation were business firms organized less than a year ago. These establishments were brokers who had been buying chemicals nominally for defense purposes and creating local "corners" on the markets involved. Thus, they had been able to collect prices claimed to be from 100 to 400 percent above the justifiable market.

In striking contrast with these problems is the reaction reported to Washington on the imposition of ceiling prices for such things as ethyl alcohol, acetic acid, and the few other important chemicals for which regulation has been attempted. O.P.A. executives have received principally compliments for the procedures and price levels fixed. A negligible percentage of industry has objected, they report.

In its plans for further price ceiling activity with respect to chemicals, the O.P.A. indicates a very conservative attitude. Increased costs are recognized. And the necessity for certain price rises is admitted. It is hoped, however, that price ceilings can be imposed to prevent "unscrupulous minor factors in an industry from developing sudden upsurge of price as an aftermath of legitimate moderate price adjustments." Some of the marketing executives of the chemical industry who are finding this attitude at O.P.A. are undertaking to report price changes contemplated in advance of public announcement so that official cooperation can be developed in an orderly fashion.

Lend-Lease Chemicals

Phosphates, nitrates, CWS equipment and materials, and explosives comprise the bulk of the chemical industry's contribution to the lend-lease program, the President's second report on distribution of the first seven-billion-dollar fund shows. The report was sent to Congress in September, showing that practically all of the first appropriation had been allocated and that half of it was under contract. Actual deliveries and shipments, while increasing sharply each month, still lag far behind—at the end of August expenditures were roughly $399 millions, exports $190 millions.

The report disclosed that $12,850,000 was allocated as of Aug. 31 for phosphates, of which $4,446,047 was under contract and $636,057 delivered. Another half-million was allocated for nitrates, but no contracts had been

placed. Lumped together in the report as "other chemicals" were allocations of $13,912,041, with $6,939,583 under contract and one-tenth of this amount delivered.

Another $6,266,536 was earmarked for chemical warfare equipment, materials and supplies, with $4,223,891 of this under contract and $874,490 delivered. Explosives, propellent powders and miscellaneous ammunition allocations were lumped at just a little under $20 millions, with contracts totaling $4,032,195 and deliveries $810,244. Other allocations for ammunition—small arms, artillery, aircraft and torpedo—brought the total in this category to nearly $600 million, of which $259 million was under contract and $7,054,584 delivered.

Munitions Plants

The Army's second chain of munitions plants neared the half-billion dollar level in September. In addition, expansion of plants already in operation or building from the first program started last year now totals nearly $150,000,000 more.

Acceleration of the Army program of hiring old-time industry management, although operating in unrelated fields, to ease the shortage of management directly allied to munitions-type operation is seen in the second program. The ammonium picrate plant at Marche, Ark., for instance, is to be operated by Cities Service Defense Corp., and the ammonium nitrate plant at Baxter Springs, Kan., by the Military Chemical Works, specially created subsidiaries of Cities Service and of Pittsburg and Midway Coal Mining Co. respectively. Similarly, operating contracts for shell and ammunition loading assemblies have been given U. S. Rubber Co., the J-M (for Johns-Manville) Service Corp., Lone Star (B. F. Goodrich) Defense Corp., and the Sherwin Williams Defense Corp. General Tire Engineering Co. is to handle a bag loading plant.

New Magnesium Plants

In the latter part of September the Federal Loan Administrator announced that arrangements had been completed for the erection of two more plants for the manufacture of magnesium. The Mathieson Alkali Works, Inc. of New York will build and operate a plant at Lake Charles, La. It will cost approximately $16,000,000 and will have an annual capacity of 36,000,000 pounds of metallic magnesium. The other plant will be built and operated by the International Agricultural Corp. Operations will be divided between the company's plant at Carlsbad, N. Mex. where magnesium chloride will be produced and a plant to be erected at Austin, Tex. where the magnesium chloride will be converted into the metal. Overall cost of the project is given as $12,317,000.

Second Program

TYPE	LOCATION	COST	OPERATOR	CONTRACTOR
Ammonia	Sterlington, La.	$15,807,086	Commercial Solvents	M. W. Kellogg Co.
Ammonia	Louisiana, Mo.	16,073,800	Hercules Powder	Bechtel-McCone-Parsons Corps.
Ammonium picrate	Marche, Ark.	12,107,420	Cities Service Defense Corp.	Lummus Co.
Ammonium Nitrate	Baxter Springs, Kan.	16,706,700	Military Chemical Works (Pittsburgh & Midway Coal Mining Co.)	Chemical Const. Co. Freeto Const. Co.; F. H. McGraw & Co.
TNT-DNT-Tetryl	Chattanooga, Tenn.	25,761,820	Hercules Powder	Hercules
TNT-DNT-Tetryl	Childersburg, Ala.	25,761,820	Brecon Loading Co.	Sullivan, Long & Hagerty; Algernon Blair
Small Arms Ammunition	St. Paul, Minn.	30,486,000	Federal Cartridge Co.	Foley Bros, Inc. Walltridge-Aldinger Co.
Small Arms Ammunition	Des Moines, Iowa	28,558,331	U. S. Rubber Co.	Weits Co. Inc., J. S. McLaughlin & Sons; Central Eng. Co. Prester Const. Co.
Small Arms Ammunition	Salt Lake City, Utah	30,485,000	Remington Arms Co. Inc.	Broderick & Gordon
Ammunition loading	Parsons, Kans.	27,111,620	J-M Service Corp. (Johns Mansville)	None
Ammunition loading	Texarkana, Tex.	33,500,000	Lone Star Defense Corp (B. F. Goodrich Co.)	Lummus Co.
Ammunition Loading	Minden, La.	19,356,908	Silas Mason Co.	Silas Mason Co.
Ammunition Loading	Jacksonville, Ark.	33,500,000*		
Ammunition Loading	Carbondale, Ill.	23,589,095	Sherwin Williams Defense Corp.	M. J. Boyle & Co. S. A. Healey
Oleum	Copperhill, Tenn.	2,375,000	Tennessee Copper Co.	None
Lead Azide	Wilmington, Ill.	869,000	duPont	Stone & Webster
Smokeless Power	Choteau, Okla.	60,006,278	duPont	duPont
Chemical Shell	Huntsville, Ala.	29,000,000	CWS	C. G. Kershaw Const. Co. Engineers Ltd. Walter Bulter Co.
Bag Loading	Flora, Miss.	11,970,202	General Tire Eng. Co.	None
Bag Loading	Childersburg, Ala.	10,527,816	Brecon Loading Co. (Coco-cola)	Weidmer & Singleton.

* Amount allocated; actual contract cost not announced

Expansion of First Program Plants

TYPE	LOCATION	COST	OPERATOR
TNT-DNT	Sandusky, O.	$9,252,911	Trojan Powder
TNT-DNT	Weldon Springs, Mo.	14,131,060	Atlas Powder
Ammunition loading	Union Center, Ind.	9,000,000*	Todd & Brown
Ammunition loading	Wilmington, Ill.	9,400,000*	Sanderson & Porter
Ammunition loading	Milan, Tenn.	2,645,350	Proctor & Gamble
Ammunition loading	Ravenna, O.	5,382,907	Atlas Powder
Ammunition loading	Burlington, Iowa	5,906,996	Day & Zimmerman
Ammonia	Morgantown, W. Va.	18,848,000	duPont
Small Arms Ammunition	St. Louis, Mo.	58,850,000*	Western Cartridge

* Amount allocated; actual contract cost not announced.

Chemical Miscellany

Floor Taxes—Stocks on hand at the time new taxes take effect are subject to the same levies as new production, in most cases. With the imposition of numerous new excise taxes, effective October 1, corresponding levies were made on comparable goods, whether in the hands of original producers, general distributors, brokers, dealers, or users. Accurate inventory of material as of October 1 was, therefore, very necessary with respect to any commodity newly taxed. The same principle will, it is assumed, be later applied if new levies are imposed in any later tax measures. The purpose is, of course, to make unprofitable and unnecessary the building up of stocks on hand in the advance stages of distribution in an effort to anticipate, and therefore to evade, new taxes.

Tariff Cuts—The first proposal to remove all import duties on materials imported for government use has apparently been defeated without formal Congressional action. A new measure which stands some chance of enactment is of like nature but of limited application. It would eliminate the tariff on any strategic or critical material brought into the country by the defense corporations which are subsidiary to R.F.C. Its effect would be limited to imports up to July 1, 1943. Even this measure is being opposed by many in industry on the ground that it breaks down the tariff set-up and gives the government no actual relief. The critics of the proposal point out that the duty collected is merely a bookkeeping transaction and elimination of the duty merely permits the import corporation to do more business than Congress expects.

Allocation Plan—Shortly a system of allocation will replace the priority plans now followed. The change is not likely to be sudden, but will be vigorously applied to one commodity after another as rapidly as possible. Under the old scheme the control of commodity was by granting a permit to a purchaser to get the material. The new allocation plan exercises control by giving orders to the producer of a scarce material as to where he may ship his output. The effect, of course, is the same so far as goods movement. But the plan of allocations is much

more simple and much more readily enforceable.

Anti-Freeze Warning—Official Washington knows that anti-freeze will be scarce this fall. O.P.A. has, therefore, issued a warning that motorists should not pay more than $1 to $1.50 per gallon for anti-freeze alcohol. They urge persons unable to buy at these prices to report their problem to Washington. Washington notes also that there would have been very little anti-freeze for anyone if quick action had not been taken during the late summer greatly to stimulate alcohol output at whiskey distilleries.

Tank Car Shortage—Statements from authoritative sources are still absolutely conflicting with respect to available tank cars for petroleum and gasoline transport to the Eastern states. Petroleum Coordinator Ickes' figures prove that not over approximately 5,000 cars can be furnished for this service. Railway officials with equal confidence guarantee that 20,000 cars, or nearly enough to offset shortages, can be put into this service immediately.

The two statements can be reconciled only when the word "available" is defined as the two parties use it. Ickes' office regards a car as available only when it is standing idle doing nothing. The railways regard cars as available for this service if they can, according to railway philosophy, be taken away from somebody else and put into more efficient long-distance transport service. Railway executives admit that they can get the 20,000 which they promise only by taking many of them away from shorthaul ineffective service. But the railways have not demonstrated to the conviction of officials that this may not create serious new difficulties in many parts of the country. Petroleum refineries and users of heating oil and gasoline are all going to be without adequate stocks while the controversy continues to rage and no pipeline is built.

Nevada Manganese—Bureau of Mines announces that it has begun operation of its pilot plant at the Boulder City, Nevada, station of the Bureau. The new unit has a capacity of 40 tons of ore per 24-hour day. Initial operation has been on a run-of-mine manganese ore averaging 18 percent metal. By flotation and subsequent sintering, a satisfactory product has been made on semi-works scale containing 52 percent manganese with 1 percent iron and 9 percent silica. Recovery of manganese from the ore is about 70 percent; but higher recovery is expected after further experience. No cost estimates have yet been released, nor is the Bureau ready to recommend commercial imitation of this project as yet.

Stream Pollution—Senator White and other members of the Maine delegation in Congress are again attempting to secure legislation preventing stream pollution. The proposal again is the establishment of a new division in Public Health Service. Effort of this sort has been defeated in two previous Congresses by controversy over the degree of compulsory reform authority which should be granted to P.H.S.

General Brehon B. Somervell, chief constructing quartermaster U. S. Army addressing workmen at new Chemical Warfare Service plant nearing completion at Monsanto, Ill.

Deal With Soviet—Uncle Sam has agreed to buy $100,000,000 worth of minerals from the Soviet. Ten per cent of the purchase price was immediately advanced by R.F.C., and up to 50 per cent will be available for purchases in the United States by the Russian Government agency Amtorg Trading Corp., even before purchased goods reach the United States. Delivery over several years is expected of manganese, chromite, asbestos, platinum, and other scarce minerals.

Classes of Industry—O.P.M. is undertaking to catalog industries in the order of their importance. Those directly responsible for war materials top the list. Those producing purely "luxury" civilian items are at the bottom. This classification is made in preparation for a more rigid set of rules under which scarce materials will be allocated to users according to the importance of their activity in the defense program.

Plastic Plant Delay—Washington has consistently sought increase in capacity for manufacture of plastics. But the proposal to expand the plant of Tennessee Eastman Corp, at Kingsport, Tenn., was denied requisite priorities by SPAB. One reason given was the necessity for using large quantities of critical materials, especially stainless steel. But more significant was the second reason stated, "hundreds of similar applications are on hand, and no single one can properly be granted until it is known how much of a drain on scarce materials would be involved in granting all of them." Thus, O.P.M. undertakes to avoid favoritism in priorities.

More Power Capacity—An extended program for expansion of present power plant capacity by almost 50 per cent of present installed horsepower has been disclosed by Federal Power Commission. The total cost of projects considered will exceed 1.5 billion, and the time required for execution will be at least three years. The bottleneck is ability to get the boilers, turbines, and generators from existing shops. Deliveries on new orders if taken in chronologic order would be at least thirty months away.

Chlorine for Paper—A new instruction regarding allowances of chlorine for paper manufacture has been issued by O.P.M., effective September 22. Chlorine is not to be supplied for makers of paper from rag stock in amounts greater than 80 percent of the quantity used in the first half of 1941. The limit for manufacture of semi-bleached papers is 70 percent. Where the chlorine is used as a processing agent, rather than a bleach, restriction is not made.

Paint Formulas—Early experience with new paint formulas, devised to sav scarce materials, has been very satisfactory in the opinion of the Department of Commerce. The Department now forecasts that some of these new paints will continue successfully in competition with older varieties, even after the Emergency because they have demonstrated real merit. The changes referred to include both modifications of drying oils and changes in the pigments and gum components of various finishes.

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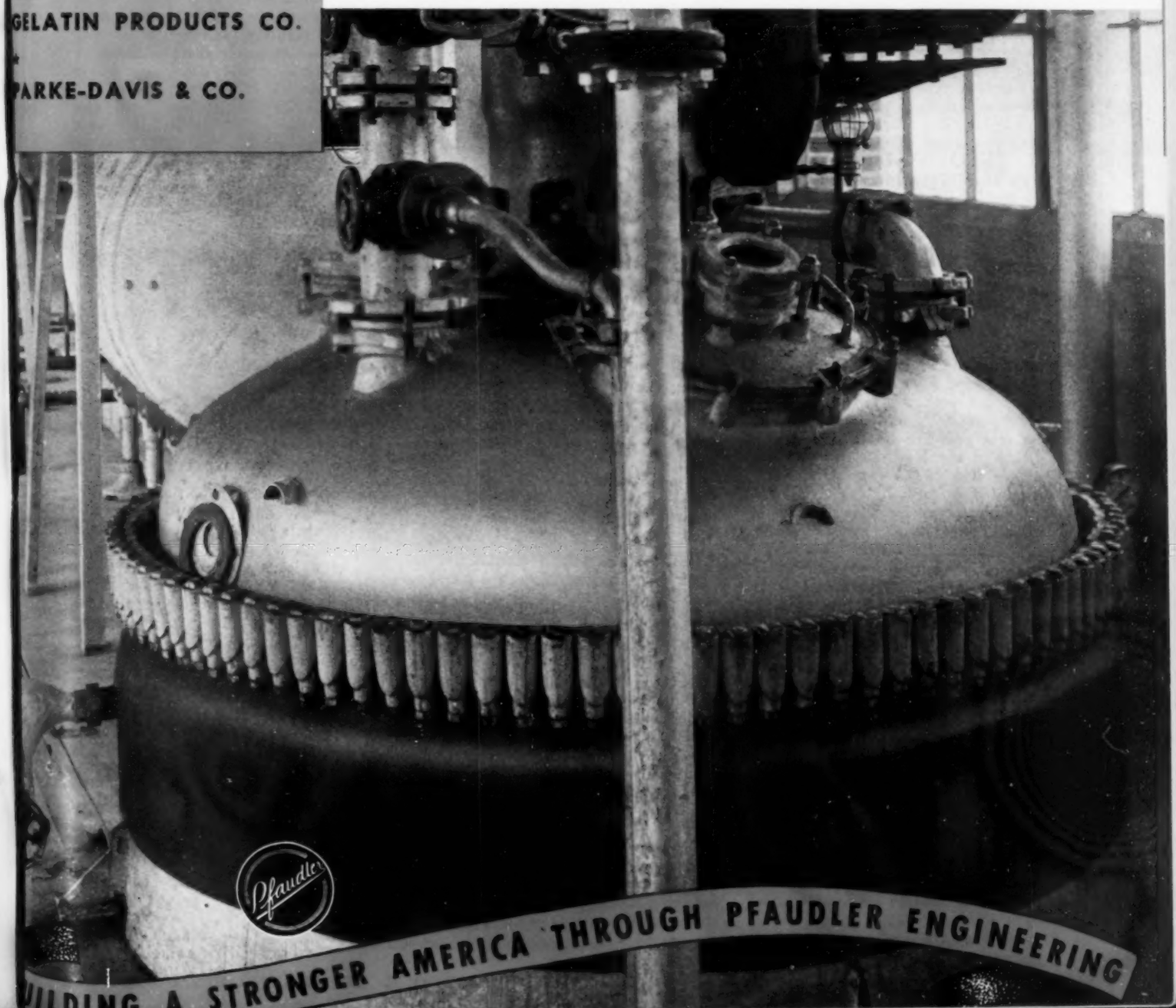


CHEMICAL ENGINEERS WILL MEET AT VIRGINIA BEACH

One of the principal features of the annual meeting of the American Institute of Chemical Engineers which will be held at Virginia Beach, Nov. 3–5, will be a symposium on "Mobilization of Engineering Materials for National Defense." It will be in charge of Fred W. Willard, president of the Nassau Smelting & Refining Co., who is the representative of the Institute on the executive committee of the Engineers Defense Materials Board—a newly formed organization made up of representatives from the civil, electrical, mechanical, mining and metallurgical, chemical, and automotive engineering societies.

Principal speakers at the symposium will be R. E. McConnell, Chief of the Conservation Unit of the Office of Production Management and newly elected chairman of the Engineers Defense Materials Board, and Dr. E. R. Weidlein Chief of the Chemical Unit of the Office of Production Management. The meeting will discuss current shortages of chemicals and metals, as well as petroleum products, and suggest means of increasing production, conserving available supplies, finding substitutes, simplifying operations and production.

Technical sessions will open on the morning of Nov. 3 with Francis C. Frary presiding. Papers will include "The Chemical Industries of Tidewater Virginia" by R. C. Bardwell, Chesapeake and Ohio Railway Co.; "Multi-Layer Construction of Thick-Wall Pressure Vessels" by T. McLean Jasper and C. M. Scudder, A. O. Smith Corp.; "Practical Methods for Storing Volatile Liquids" by D. E. Larson, Chicago Bridge & Iron Co.; and "The Cathodic Protection of Aluminum Equipment" by R. B. Mears and H. J. Fahrney, Aluminum Research Laboratories.

This session will continue on the following day with the program including "Sodium Silicate and Hydrochloric Acid from Sand, Salt and Steam" by K. H. Iler and E. J. Tauch, E. I. du Pont de Nemours & Co.; "The Solubility of Olek Acid, Abietic Acid, and Their Mixtures in Propane Up To The Critical Temperature"; by A. W. Hixson, Columbia University and A. N. Hixson, University of Pennsylvania; "Performance of Refinery Gas Absorbers With and Without Intercoolers" by R. M. Jackson, Standard Oil Development Co. and T. K. Sherwood, Massachusetts Institute of Technology; "The Rate of Absorption of Carbon Dioxide in Diethanolamine Solutions" by D. S. Cryder, Pennsylvania State College and J. A. Maloney, E. I. du Pont de Nemours & Co.; "Packed Tower Performance at High Liquor Rates—The Effect of Gas and Liquor Rates Upon Performance in a Tower Packed with Two-Inch Rings" by C. M. Cooper, R. J. Christl and L. C. Peery, duPont; "Distillation in a Wetted-Wall Column" by H. F. Johnstone and R. L. Pigford, University of Illinois; also on the same subject by A. J. Surowiec and C. C. Furnas, Yale University; "The Effect of Operating Variables on The Performance of a Packed Column Still" by D. W. Duncan, Procter and Gamble Co. and J. H. Koffolt and J. R. Withrow, Ohio State University; "Rectification in the Presence of an Insoluble Component" by E. M. Schoenborn, University of Delaware; "Flooding Velocities in Packed Towers—Comparison of Determination by Visual and Pressure Drop Methods" by B. R. Sarchet, Koppers Co.; "Limiting Flows in Liquid-Liquid Extraction Columns" by F. H. Blanding, Standard Oil Co. and J. C. Elgin, Princeton University.

The technical session on the morning of Nov. 5 will be in charge of S. D. Kirkpatrick. Papers scheduled for presentation are "Drying of Solids by Through-Circulation" by W. R. Marshall, Jr. and O. A. Hougen, University of Wisconsin; "Factors Influencing Rotary Dryer Performance" by C. F. Protton, C. O. Miller and W. H. Schuette, Case School of Applied Science; "Liquid-Liquid Extraction in Wetted-Wall and Packed Columns" by E. W. Comings, University of Illinois and S. W. Briggs, Gulf Oil Co.; "Experimental Study of Individual Transfer Resistances in Countercurrent Liquid-Liquid Extraction" by D. G. Welsh, Hercules Powder Co. and A. P. Colburn, University of Delaware; "Countercurrent Liquid-Liquid Extraction in a Wetted-Wall Tower" by R. E. Treybal, New York University and L. T. Work, Metal & Thermit Corp.

PROFESSIONAL ENGINEERS WILL MEET AT NIAGARA FALLS

The fall meeting of the New York State Society of Professional Engineers will be held in Niagara Falls, Oct. 24-25 with the Niagara County section in charge of the meeting. S. V. Jenkins, Professional Engineer of the Niagara Chapter, has been appointed chairman of the general committee. More than 300 Professional Engineers are expected to attend the sessions which will be keyed to the industry's all-out effort to speed defense. An interesting convention program has been arranged which includes several outside trips to places of technical and scenic interest.

ILLINOIS GLASS CONFERENCE POSTPONED TO NOVEMBER

The dates for the Seventh Conference on Glass Problems to be held at the Department of Ceramic Engineering, University of Illniois, Urbana, have been advanced from November 7-8, to Nov. 14-15. This change has been made necessary because of conflict of the earlier dates with a previously scheduled meeting which brings thousands of strangers to the Campus and taxes all the local rooming and restaurant accommodations.

The program for the Conference is sufficiently organized so that the usual interesting sessions are assured. Some of the topics to be discussed are: molds for glass, batch feeding, cords and stones in glass, and fitting color decoration on glass.

CONCANNON TO SURVEY CHEMICAL INDUSTRY IN THE SOUTH

Charles C. Concannon, chief consultant on chemicals of the Department of Commerce, has been designated to conduct a survey of the chemical industry throughout the southern United States and to meet with representatives of the industry for discussion of the newly-inaugurated industrial reporting program designed to establish better and broader contacts between the government and the chemical industry.

Information developed in the industrial reporting program for the chemical industry will be reported monthly by the field officers of the Department of Commerce in territories where the chemical industry is of major importance. In general, these officers, through personal interviews and frequent consultations with chemical firms, will report on the major present and prospective problems of the industry.

Reports will include data on production, storage sale, delivery and consumption of chemical products, analyses of problems arising in these fields of the industry, and actual or suggested solutions for these problems by the producers and manufacturers of chemicals.

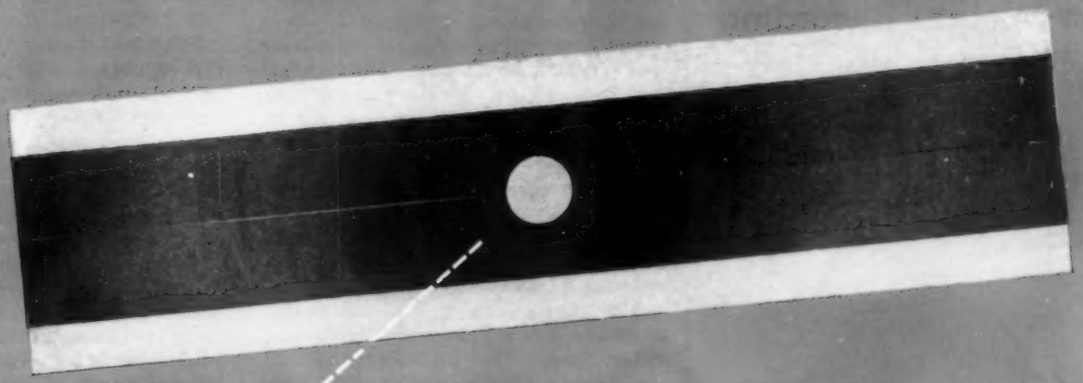
The reporting service will also furnish the chemical industry with current production data as affected by changes in the rate of activity, the rate of plant operation, the effects of various government actions including priorities, taxation, inter-state trade barriers and price and export controls, and the effects of machinery shortages.

Information gathered on chemical plant facilities will include reports of effected or planned plant expansions, shifts to production of defense goods or substitute civilian goods, the proportion of facilities devoted to defense orders and changes in technical or mechanical processes.

SEMINAR ON ELASTICITY AND PLASTICITY AT BROOKLYN POLY

The Department of Chemistry of the Polytechnic Institute of Brooklyn announces a series of seminar meetings on "Elasticity and Plasticity" under the joint leadership of Prof. Hermann Mark, Prof. Wm. H. Gardner, and Dr. Robert Simha. It is planned to hold these seminars on alternate Saturdays, with the first meeting on October 18. All interested chemists are invited to attend and participate in the discussions.

The seminar will discuss from a fundamental point of view the mechanical properties of deformable materials, ideal elastic solids, Newtonian liquids and complex plasto-elastic systems will be discussed, with particular emphasis upon their molecular structures. Such a systematic study of plastic and elastic behavior is of particular interest today, with the rapid development of many new synthetic, materials, each designed to fit specific mechanical needs.



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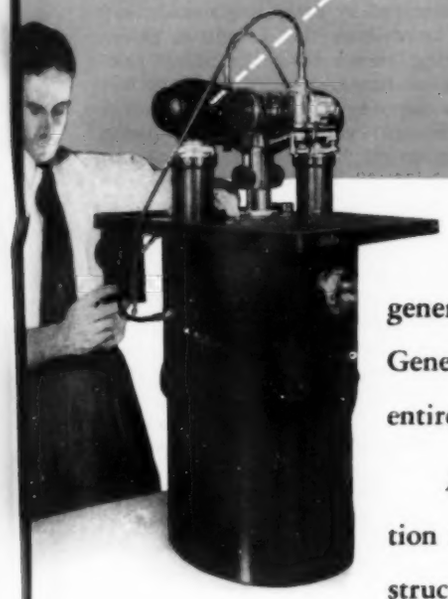

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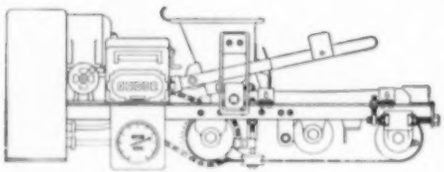

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PROLONGATION OF RUSSIAN CAMPAIGN MAKES GERMAN OIL SITUATION MORE PRECARIOUS

Special Correspondence

GERMANY'S largest private industrial concern, I. G. Farbenindustrie, paid 213 million RM in taxes in 1940 to help finance Reich war operations, according to the latest annual report. This contrasts with 125 million RM paid in 1938. An increase in I. G. Farben's capitalization by another 100 million RM was also announced, partly to cover expansion projects in allied and occupied territory, and especially to finance a new Franco-German chemical company.

A measure that will affect the financial structure of the large concerns in the Reich is aimed to prevent a further rise in security prices. Large industrial concerns are asked to discontinue the practise of investing idle funds in stocks and are required to place as much of their surplus funds as possible in Reich bonds. It will be recalled that even with the sharp increase in expenditures occasioned by the extension of the war to the Russian front the Reich plans to foot the current war bill as before by raising half the money by taxes and half by government borrowing.

The longer the Russian campaign continues, the more precarious the Reich's oil position becomes. Whereas the Wehrmacht and Luftwaffe claim that from the beginning of the Polish campaign to the fall of France through using Blitzkrieg tactics they consumed only 12 million barrels of gasoline, diesel oil, and lubricants, this, they claim, was more than offset by the capture of at least 20 million barrels of oil in France and the Low Countries. The present long-front campaign will necessitate dipping into reserve stocks, and the Caucasian production of 200 million barrels yearly and possibly later the Near East output of 120 million barrels must loom as prizes, probably largely motivating the attack on Russia.

In addition to supplying its own war machine, Germany must also keep the economic machinery of allied and occupied territories running. In 1938 Europe consumed over 200 million barrels of oil and produced only 75 million itself, not counting Soviet production, little of which was available for export. Rumania's yearly production is only 45 million barrels, or between 5 and 6 million tons—in Europe oil statistics are usually in terms of metric tons and not barrels—while the Reich's own natural oil production is not significant. Germany will be able, however, in some 30 synthetic plants to supply around 30 million barrels of synthetic oil this year. Experts estimate that in 1941 German-controlled Europe will need a minimum of 115 million barrels if military needs are the same as in 1940. Synthetic and natural production can be strained to produce at best 100 million barrels, but this still leaves a 15 million barrel deficit, which Germany is trying to cover through further elimination of "non-essential" civilian consumption of oil, building up of reserves, admixtures of alcohol and benzol with gasolines, using more wood or charcoal gas generating motors, and stepping up synthetic production under Bergius and Fischer-Tropsch processes to the utmost. The synthetic processes, however, still do not yield an economically satisfactory lubricant, and German planes have to fly mostly with 87 to 92 octane gas instead of 100 octane aviation fuel. Since 1938 the Reich has succeeded in trebling synthetic oil output, and neutral sources report that few of the coal hydrogenation plants have been seriously damaged by air raids. On the other hand, as far as the Russian campaign is concerned, it may be assumed that oil stocks as well as oil wells will be destroyed by retreating armies, and this as well as the difficulties of organizing transport facilities would postpone the benefit that control of these areas might give the Reich.

With an eye to controlling future European oil production the Kontinentale Oel A. G. was formed in Berlin as a holding company earlier this year with the participation of I. G. Farben, Braunkohle Benzin A. G., Vereinigte Stahlwerke, and other interested concerns. Even though the 80 million RM capitalization of this holding firm is low, it is of interest to note that the founding companies are being given a 50-fold vote with each share of their first 50 million RM preferred stock so that they will retain control even after capitalization has reached officially boasted "billion mark dimensions in competition with Anglo-Dutch-American monopolies." In the World War the Reich had similar plans for Rumania, but in 1918 had to relinquish control.

Synthetic oil costs two to three times as much as the natural product. Thus large scale production in the future will be limited to countries with adequate coal supplies, and this means in Europe, England and Germany. Even in this field, however, the Reich is experiencing considerable difficulties in keeping up coal production and in supplying dependent countries. Employment of less-skilled and war-weary labor has reduced per-man output in German coal mines in the last few years. Output per shift per man now averages 2 tons in the Ruhr, 2.4 tons in Upper Silesia, and 1.4 tons in the Aachen coal district. Concern over this drop is reflected in the recent complete reorganization of the coal industry and in the attractive prizes being offered to machine building companies which develop new machinery to mechanize and speed up coal output in the direction of an ultimate goal of 10 tons per man per shift.

How the partly German-owned Swiss chemical industry is faring is revealed in the annual reports of the three largest firms. Sandoz A. G., Basel, showed a decrease in net profits from 6.9 million Swiss francs to 5.1 million francs in 1940 as against 1939, but stated that its turnover had held up despite war difficulties. F. Hoffman-La Roche and Co., Ltd., showed a slight increase in net profits from 3.18 million francs to 3.23 million, and in its report stated that production and employment in its Basel plant had increased. CIBA (Society of Chemical Industry, Basel) showed a net income of 7.7 million Swiss francs in 1940 as compared with 11.3 million in 1939, and declared a dividend of 17 percent for 1940 as against 20 percent the preceding year. The Basel I. G., comprising the three firms CIBA, Geigy, and Sandoz, recently purchased the majority shares of Durand and Huguenin A. G., another important Swiss firm.

For civilians Switzerland has restricted gasoline consumption—only 15,000 of its 120,000 automobiles are reported running—and copper has been severely rationed. In general the republic is living satisfactorily on reserve stocks of foods, soaps, shoes, and textiles, and civilians have enjoyed a higher standard of living than most Europeans. Nevertheless, as it becomes more difficult to obtain overseas supplies, especially of foodstuffs, the drive to raise more food domestically becomes more important. With only a small part of the country usable for agriculture, 125,000 acres of new land have been put under cultivation this year to supplement the 450,000 acres already under cultivation when the war broke out.

In Germany mechanization of agriculture is being pushed. The difficulty with further mechanization is the same as in Russia. In the Soviet Union after large numbers of horses had been slaughtered in the early 30's, partly as a protest against collectivization, and tractors and harvester combines were introduced on a large scale, it became apparent that the whole farming system and food supply depended on oil needed to run the mechanized equipment. The oil shortage in the Reich is causing a serious obstacle to further mechanization right now, and partly explains the use of so much unskilled foreign labor. To supplement the 2 million foreign workers already in German farms and factories, agreements have just been concluded to import more laborers from Rumania and Spain. Nevertheless, if grandiose plans for post-war reorganization of all German villages, as reported by the German Institute for Business Research, materialize, 6,700 million RM of a total 40,000 million RM budget for the project will go for farm mechanization. From 1933 to 1939 the number of tractors in use of farms in Germany nearly trebled, while the number of light and heavy-oil motors used on farms doubled.

German expectations of being able to add part of the Ukraine food supply to this year's harvest have apparently not materialized as retreating Russians have burned crops. However, crops in the Reich are expected to be relatively favorable this year. Since there will be more difficulties in transport than ever before, a greater effort will be made to preserve as much of this year's crop as possible, partly to build up food reserves.

The much-advertised aluminum cans are apparently not yet entirely satisfactory. Their commercial production is also being held up by priorities calling for using aluminum for other purposes. Until aluminum production has increased sufficiently, it is admitted that aluminum will not be widely used as a tin can substitute in Germany.

NATIONAL METAL CONGRESS WILL OPEN OCTOBER 20

The 23rd National Metal Congress and Exposition to be held in Philadelphia for five days beginning October 20 will be headlined by a series of important national defense group meetings on defense problems, conservation and substitution. The announcement is made by W. H. Eisenman, managing director of the Exposition and secretary of the American Society for Metals.

"It is felt that present conditions make it incumbent upon the Society to arrange for its members, for industry and others in attendance at the Metal Congress an intensive picture and study of the situation as it exists at the present time," Mr. Eisenman said. "It will present an opportunity to have conversant individuals indicate the future trends in important commodities and scarce materials."

Thirteen special defense meetings will present more than a hundred specialists actively engaged in either industrial defense activities or government planning in the present emergency. Sessions will be held during late morning, afternoon and evening during the five days of the Metal Exposition. Invitations have been extended by the American Society for Metals to highest ranking officials from the War Department, Navy Department and the Supply Priorities and Allocations Board.

LALOR FOUNDATION FELLOWSHIPS FOR 1942-43

Under the program for the Sixth Annual Series of Fellowship Awards of the Lalor Foundation, Wilmington, Del., nine leaders in scientific research have been named, each to nominate the recipient and administer one Fellowship of the 1942-43 Series of Lalor Research Awards.

The Fellowship Awards are for the academic year 1942-43 and each will carry a stipend of $2,000. The degree of doctor of philosophy or the equivalent is the minimum requirement for candidacy. The awards are open to both men and women residents of the United States or Canada.

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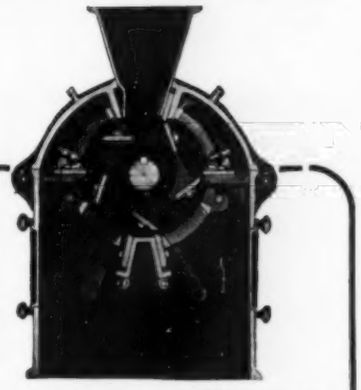

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GREATER CONTROL OVER CHEMICALS AND SKILLED CHEMICAL WORKERS IN BRITISH INDUSTRY

Special Correspondence

THERE have been a few price changes lately in the British chemical markets, but the pressure of demand remains unabated. There is a large call for virtually all industrial chemicals, and supply is scarcely adequate to meet all requirements. This applies in particular to imported products such as potash compounds—permanganate, caustic, carbonate, and yellow prussiate—while tartaric acid, previously in very heavy demand, is now somewhat more easily obtainable. The demand for sodium compounds has spread out, with the result that the call for chlorate, yellow prussiate, and bichromate is now apparently in excess of available supplies.

The improvement of the shipping position has, however, resulted in an alleviation in certain chemical markets. Thus drugs are now in a somewhat more comfortable position. Pharmaceutical producers using raw materials which are also required for other purposes still meet with difficulties. Thus it is reported that makers of salicylates are rationing their customers because smaller supplies of phenol have been allocated to them by the Tar Products Control. All tar-distillation products are in strong demand. Wood naphtha is now also under government control.

An important new development has been the establishment of a Miscellaneous Chemicals Control which is for the time being concerned only with chromium pigments and compounds, chlorates and titanium dioxide, but may take over control of other chemicals. The control of skilled labor for chemical factories will in future be in the hands of Local Labor Supply (Chemical Industry) Committees. Substantial progress has been made with them already in most areas.

The export trade of the British chemical industry will not apparently be affected greatly by the arrangements between the British and American authorities. British chemical exports were in peacetime largely directed to countries of the British Empire. Exports to other countries consisted to a large extent of industrial products and raw materials which are now required in the home market. The surplus of sodium compounds and coal-tar derivatives available for the export market is certain to have declined substantially. Although Great Britain used to hold a strong position in the alkali trade, market reports suggest that virtually all of this output is required by domestic trade.

New chemical products which have recently made their appearance include a preparation by a leading dyestuffs manufacturer which will permit wool printers to produce as bright colours and pastel shades as are obtained on other printed fabrics. The new preparation gives a chalk white background which is claimed to give cleaner printing effects, more depth and body.

A substitute for agar-agar, gum acacia, tragacanth and the alkaline stearates is provided by a new cellulose derivative emulsifying agent. With water it forms a viscous colloidal neutral solution stable to light and temperature increases. The solid film remaining on evaporation is insoluble in the usual cellulose solvents.

The use of lactic acid as a natural food preservative was mentioned by Dr. William Clayton. Addition of 0.3 percent of lactic acid prevents softening of pickles. Lactic acid can be used against cloudiness of olives, for meat (particularly pork) curing and to control "rope" in bread. Fumigation with ethylene oxide protects cereals, dried fruit, nuts, spices. Ice containing sodium hypochlorite keeps fish wholesome much longer than does ordinary ice. Certain metal ions, especially silver, may be used for sterilizing water and clear liquids such as fruit juices and wines.

New chemical products for the rubber industry include special organic dyestuffs for marking of uncured stocks of rubber, a new wetting agent which may be added to latex in order to facilitate impregnation or other applications in conjunction with textile materials, a method for de-ammoniating latex with formaldehyde, a simple reclaiming technique for neoprene.

Reports that very large tonnages of phosphatic and potassic fertilizers are to be supplied during the coming season by American producers have been greatly welcomed in the fertilizer trade. Owing to the progress made with the reclamation of waste land and transformation of grass land into tilled acreage demands for artificial fertilizers have increased greatly, while the supplies from the Continent have been cut off. Reasons of shipping will give an advantage to highly concentrated mixed fertilizers.

Fuel problems are likely to grow in importance during the coming winter and may necessitate emergency remedies. The Irish railways have begun to use a mixture of coal and peat as locomotive fuel, previous experiments having proved its utility. Tarworks may use liquid pitch as a substitute fuel for petroleum oils. The main difficulty seems to exist in the transition from a solid to a mobile liquid during heating, because pitch causes considerable operational difficulties in the intermediate viscous stage. In tarworks pitch may be supplied directly from the still to the feed tank at temperatures above 200° C, thus eliminating difficulties

which are encountered in other industries.

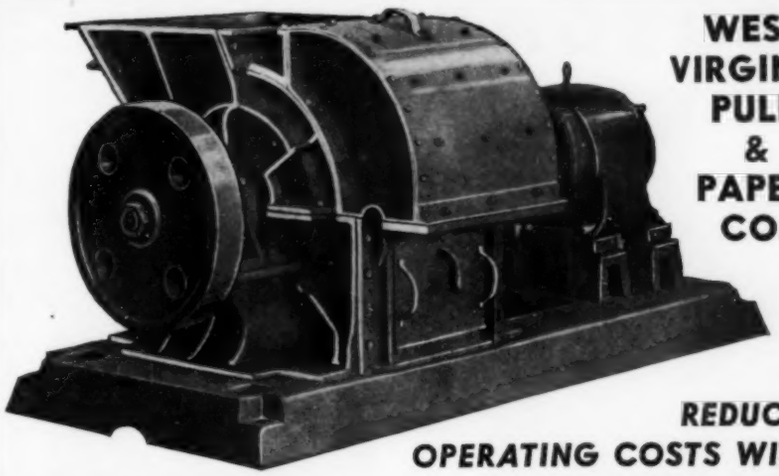
The Concentration of Industry Order which provides for production to be maintained in the most effective factories and the transfer of redundant plant to more essential war work has not apparently been applied to a large extent in the chemical industries as most works are either engaged directly or indirectly on war work or have taken over essential productions. From the plastics industry it is reported that no surplus capacity having been revealed the Board of Trade does not intend to proceed with a concentration scheme. The industry may, however, later present a voluntary concentration scheme when necessary.

The high activity in the plastics industry makes the development of processes which do not depend upon costly new equipment very important. One such process has been developed for melamine synthetic resins which, it is claimed, yields 90 percent of the theoretical optimum output and does away with the need for expensive high-pressure plant. The compatibility of these resins with non-drying and drying oil-modified alkyd resins is mentioned as a special advantage as it permits use in mixtures with a view to speeding-up and improving the hardness of alkyd resins.

Chemical processes are applied increasingly in the British textile industries. Government authorities, it is reported, insist on the application of the cupra-ammonium process for rot-proofing of cotton cloth. The ability of an ammonial solution of cupric oxide to dissolve cellulose is made use of after preparation of the cloth by wetting-out with boiling soap or one of the proprietary wetting agents available. The solution of copper hydrate is obtained by the addition of concentrated ammonia to a copper sulphate solution. Copper and zinc hydrate, copper formate and aluminum formate are alternative materials which are also used to some extent.

Plastic bearings have made much headway in recent years since metal bearings are subject to restrictions and are indeed in some respects superior to metal bearings, e.g., in that plastics being non-conductors, the loss of heat is very much smaller. In the aircraft industry plastic bearings are now used for under-carriage, hydraulic ram and pump, and power-operated gun-turret bearings. In the automobile industry water pump, stub axle, pivot pin and clutch thrust bearings are made from plastics. Even in marine engineering rudder post, stern tube and pump bearings are manufactured from this material.

The fourth addendum to the British Pharmacopoeia contains a number of new products as well as additional remarks on old-established preparations. Broadly speaking the additions give effect to changes which have taken place in medicinal research and practice in recent years.



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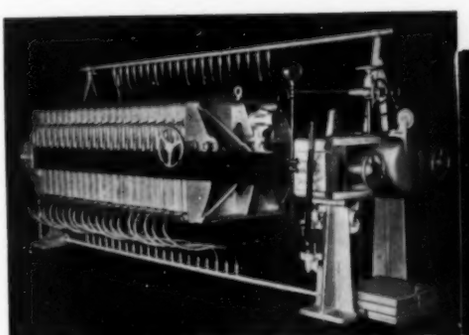

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PERSONALITIES

Felix N. Williams

Robert W. Cairns

✦ FELIX N. WILLIAMS, manager of Monsanto Chemical Co.'s elemental phosphorus plant at Monsanto, Tenn., has been promoted to the production managership of the Phosphate Division. He will have under his jurisdiction the production at the three phosphate plants of the company at Anniston, Ala., Monsanto, Tenn., and Carondelet, Mo., and the new phosphate products plant now under construction at Trenton, Mich. His headquarters for the present will be at Monsanto, Tenn.

✦ C. D. PRICKETT, vice president and director of Hercules Powder Co., retired October 1. Mr. Prickett has been with this company since its formation in 1913 when he was put in charge of all Hercules' black powder operations. Both Mr. Prickett's father and grandfather were prominent in the black powder industry, and Mr. Prickett himself has been associated with the powder business for more than 60 years. While still a school boy, he spent vacations working in the packing house of the Hazard Powder Co. plant at Hazardville, Conn., where his father was superintendent and general manager. Mr. Prickett served in various important positions in that company. In 1913 he became a director and assistant general manager of Hercules, and a few months later was elected a vice president. He was named to the finance and executive committees of Hercules in 1928 and served thereon for a number of years.

✦ ROBERT ROBINSON, Waynflete professor of chemistry at Oxford University, has been awarded Switzerland's Paracelsus Medal which is bestowed upon the scientist whom the Swiss Committee considers has made the greatest contribution to science in the world in the course of a year.

✦ ROBERT W. CAIRNS, assistant to the director of research of Hercules Powder Co., has been appointed director of the Hercules Experiment Station at Wilmington, Del., it has been announced by Dr. Emil Ott, director of research. Dr. Cairns received his A.B. degree at Oberlin College in 1927. He was awarded the Ohio State Fellowship in chemistry at Johns Hopkins University where he received his Ph.D. degree in chemistry in 1932. Following his graduation he served during 1933-34 as a fellow of the Bartol Research Foundation at Swarthmore College. He joined Hercules at the experiment station in 1934 as a research chemist in the explosives group. On May 15, 1940, he was appointed assistant to the director of research and in November was given the additional appointment of leader of the explosives group at the experiment station.

✦ CHARLES C. CONCANNON, chief consultant on chemicals of the Department of Commerce, has been designated to conduct a survey of the chemical industry throughout the southern United States and to meet with representatives of the industry for discussion of the newly-inaugurated reporting program designed to establish better and broader contact between government and industry.

✦ ROBERT R. WILLIAMS received an honorary degree from the University of Chicago at its 50th anniversary convocation on Sept. 29. Dr. Williams is director of chemical research for the Bell Telephone Laboratories, New York.

✦ O. A. PICKETT of Hercules Powder Co. has taken over new duties in the advertising department. His knowledge of the company's extensive research programs, of the chemical materials which Hercules has already established in consuming industries, and of those products still in the development stage, will be invaluable in his new capacity.

✦ DAVID M. HOUSTON, former manager, Naval Stores Export Sales, for Hercules Powder Co., has been appointed assistant director of the Export Department. Born in Ridgewood, N. J., in 1901, Mr. Houston specialized in chemical engineering at M. I. T., receiving his B. S. degree in 1923 and his M. S in 1924. He joined Hercules in October, 1924, as a chemist at the Experimental Station in Kenvil.

✦ J. F. STEPHYL, owner of the Stephyl Laboratories, Milwaukee, has been appointed as technical sales representative of the Glyco Products Co. of Brooklyn, N. Y. He will act in conjunction with Mr. E. S. Johnston of the Midcontinent Chemicals Corp.

✦ FRED C. KOCH, authority in the field of biochemistry, will give the second annual Julius Stieglitz Memorial Lecture before the Chicago Section of the American Chemical Society in the Stevens Hotel, November 14. The lecture was founded in honor and memory of the revered Dr. Steglitz, through the efforts of members of the Chicago Section, certain alumni of the University of Chicago and other friends.

✦ WARD F. SIMMONS, metallurgical engineer, has joined the technical staff of Battelle Memorial Institute, Columbus, Ohio. Prior to joining Battelle he was associated with the American Steel & Wire Co., Duluth, Minn. Mr. Simmons was graduated from the School of Mines and Metallurgy of the University of Minnesota.

✦ M. L. CROSSLEY is now director of research of the American Cyanamid Co. Dr. Crossley has been director of research for the Calco Chemical Division of the company since 1936.

✦ J. S. WALTON, former research engineer for Socony-Vacuum Oil Corp. and technologist for the Standard Oil Development Co., has joined the chemical engineering staff with the rank of professor at the University of Oklahoma where he will continue research in catalytic and thermal conversion processes. Professor Walton also has been consulting engineer with the Luis de Florez Engineering Co. of New York and has made numerous surveys of cracking processes at refineries in this country, Canada, and the Dutch West Indies. After graduating from the Uni-

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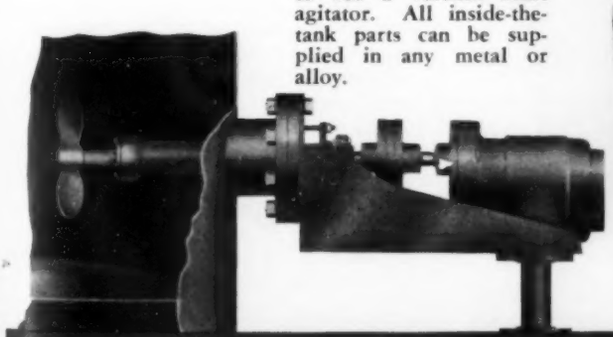

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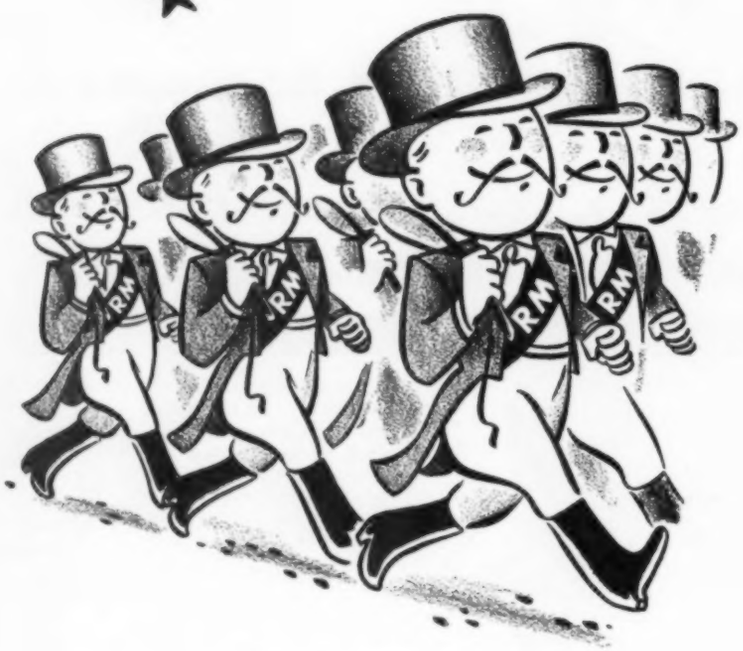

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versity of Iowa in 1928, he joined the Socony-Vacuum Oil Corp. at Augusta, Kan., where he worked on asphalt production, gasoline treating and cracking. He was a member of the research staff at Massachusetts Institute of Technology where his work dealt with high pressure polymerization of hydrocarbons, during 1929 and 1930. He was with Socony Vacuum for the next four years before making surveys for improvements of the de Florez cracking processes at refineries in the east, south and middlewest. He became senior technologist for the Standard Oil Development Co. in 1937.

Arthur P. Kroeger

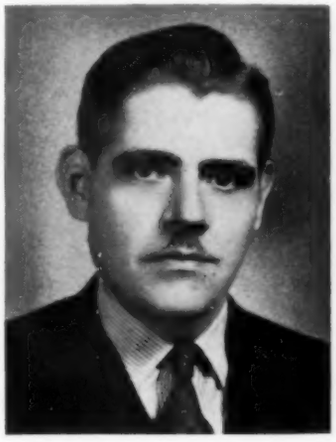
✦ ARTHUR P. KROEGER has been promoted from assistant general branch manager of the Los Angeles office of Monsanto Chemical Co. to assistant manager of sales in charge of intermediates, with headquarters in St. Louis, according to G. Lee Camp, vice president. Mr. Camp also announced the transfer of Charles L. Fetzner from the San Francisco office of the company to the Los Angeles office as assistant general branch manager to replace Mr. Kroeger. The latter joined Monsanto in 1929 as a chemist in its rubber service department in Akron, Ohio, working part time while finishing his last two years toward a degree in chemistry from the University of Akron. In 1934 he was sent to Japan and China where he sold Monsanto rubber chemicals and did technical service work. Returning to this country in 1935, he was transferred from the rubber service department to the organic chemicals division.

✦ NAAMAN H. KEYSER, a June graduate of Antioch College, has joined the research staff at Battelle Memorial Institute and has been assigned to metallurgical research.

✦ EDWIN F. PIKE has been appointed director of chemical research for the Gelatin Products Co., Detroit. Dr. Pike was previously associated with Armour & Co. as technical director for the Armour laboratories. Prior to that he spent seven years in Europe as foreign

field supervisor for the A. E. Staley Mfg. Co.

✦ DARREL E. MACK, who spent five years with the Niacet Chemical Corp. in Niagara Falls as chemical engineer and research chemist, has been appointed assistant professor of chemical engineering at Lehigh University. Dr. Mack received his Ph.D. at Purdue University.



William K. Cusick

✦ WILLIAM K. CUSICK has resigned his position with the Parker Rustproof Co. to take charge of engineering and sales work for the Ireo Zinc Coat Division of International Rustproof Corp. at Cleveland, Ohio. Mr. Cusick is a graduate of Ohio State University in chemical engineering.

✦ D. G. BAXTER has been appointed general superintendent in charge of the Copperweld Steel Co.'s Warren, Ohio, plant. Mr. Baxter is a graduate of Ohio Northern University.

✦ EDWARD J. NOLAN, JOHN B. TOY, and RICHARD M. COOLEY have been given staff positions in the new Stonewall plant of Merck & Co. at Elkton, Va., according to a recent announcement of Mr. George Merck, president of the company. Dr. Nolan has been appointed superintendent of manufacturing of the plant and will take up his duties late this year. He started with Merck & Co. in July, 1936, as an assistant factory chemist. About a year later he was placed in charge of factory No. 10 and when the solvent recovery plant was started in December, 1940, he also supervised that work. Dr. Nolan holds the degree of B.S. and M.S. in chemical engineering, and Ph.D. in chemistry from Massachusetts Institute of Technology. Mr. Toy was named plant engineer of the Stonewall plant and is already devoting most of his time to duties in connection with his new position. He joined the company in March of this year; he is a graduate of M.I.T. and holds degree of B.S. in chemical engineering. In addition to this formal training he has had varied practical

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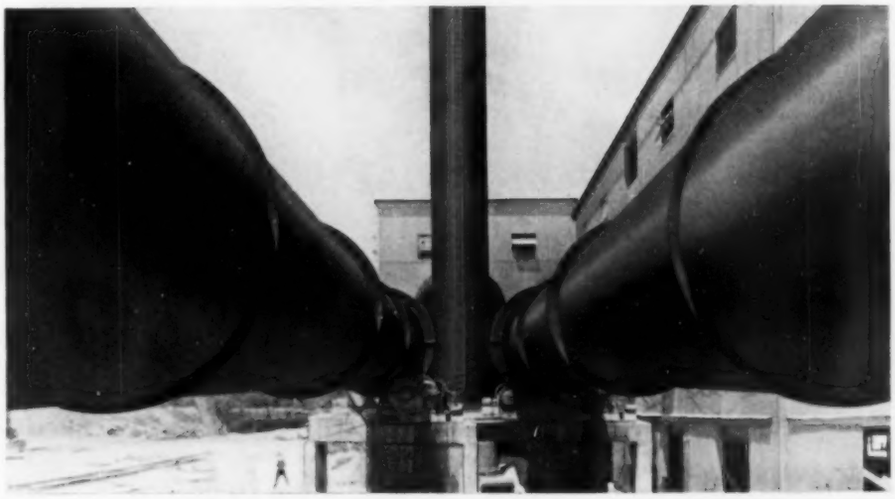

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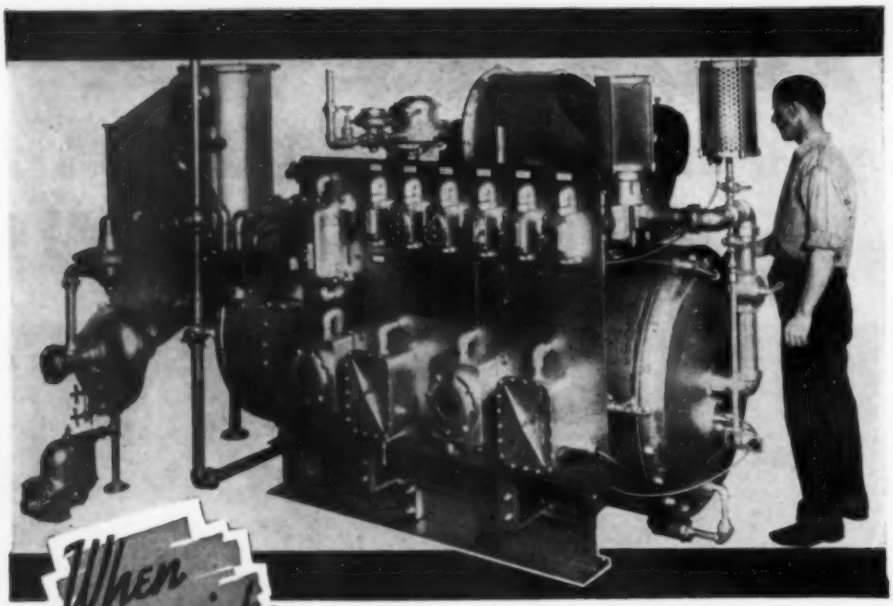

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experience in maintenance and development engineering work. Mr. Cooley was appointed to the position of manager; for the time being he will continue to direct the activities of the industrial engineering department and will carry on activities at the new plant by commuting from Rahway when necessary. He began his employment with Merck in September 1934 after graduating from Princeton University with a B.S. degree in chemistry.

✦ G. K. VIALL, vice president of Chain Belt Co., Milwaukee, has been appointed as head of a new division of research and development now being organized by that company.

✦ JACK W. BURNS, HAROLD G. JOHNSON, ROBERT F. TAYLOR and JAMES M. VAN LANEN, are among the recent additions to the research staff of Commercial Solvents Corp., Terre Haute, Ind. They are all recent graduates of the University of Wisconsin. RICHARD J. HICKEY and MERRICK W. SHEPARD are among the new arrivals from Iowa State College. P. C. MARKUNAS, University of Illinois graduate and formerly with National Distillers Products Corp., has also joined the organization. FRANK J. RUDERT, a Cornell University graduate and formerly instructor at Oregon State College, is now with the Commercial Solvents Corp.

✦ HENRY A. STROW has been appointed chief chemist of MacDermid, Inc. of Waterbury, Conn. Mr. Strow after graduation from Purdue University was employed by the Udylite Corp. as research chemist and more recently as maintenance service engineer of Detroit Transmission Division of General Motors Corp.

✦ E. C. WILLIAMS, formerly vice-president of the Shell Development Co., has been elected vice-president and director of research for General Mills, Inc., Minneapolis.

✦ ARCHER E. WHEELER, outstanding copper expert, has been awarded honorary membership in the Electrochemical Society.

✦ A. T. BEAUREGARD, assistant plant manager of the Monsanto, Tenn., plant of Monsanto Chemical Co., has been promoted to plant manager.

✦ ROBERT B. WOLF will be awarded the TAPPI Medal. This medal is awarded by vote of the executive committee to an individual who has made outstanding contributions to the technical advancement of the pulp and paper industry.

OBITUARY

✦ CHARLES H. ROBERTS, treasurer of Johns-Manville Corp., died September 10 at Yonkers Hospital where he had been confined since August 20 for treat-

ment of a heart ailment. Mr. Roberts was 51 years old and lived in Scarsdale, N. Y.

✦ BRIAN S. BROWN, president of Georgia Rosin Products Co., Savannah, died August 30 of a heart attack. Mr. Brown had been in ill health only a short time. He was 60 years old.

Harold J. Stein

✦ HAROLD J. STEIN, 47 years of age, director of research, chemistry and metallurgy at the Allis-Chalmers Mfg. Co., died September 9. Mr. Stein has directed these activities since 1939, when they were consolidated into one department upon the retirement of R. S. MacPherran, chief chemist. He came to Allis-Chalmers as a student apprentice in 1916, served in various manufacturing departments and was in turn made general foreman of the company's heat treating operations, assistant foreman of the forge department and later a research engineer. In 1936 he was made chief research engineer of all the manufacturing departments of Allis-Chalmers.

✦ RUDOLF SCHOENHEIMER, associate professor of biological chemistry at Columbia University and an outstanding research worker in the field of biochemistry, was found dead of poisoning at his home at Yonkers, N. Y., on September 11.

✦ HARUTYUN G. TERZIAN, gas engineer of United Engineers & Constructors, Inc., and formerly with United Gas Improvement Co., died suddenly of a heart attack on September 2 in Canada where he was on a business mission. He was 53 years old. Mr. Terzian was recognized as an outstanding authority on the production of carburetted and blue water gas, in which line of work he had been engaged for nearly 30 years. He started his career in the gas industry in 1913 in the gas production department of the Syracuse (N. Y.) Lighting Co. After a few years he entered the experimental plant of the United Gas Improvement Co. at Philadelphia and subsequently became manager of this plant.

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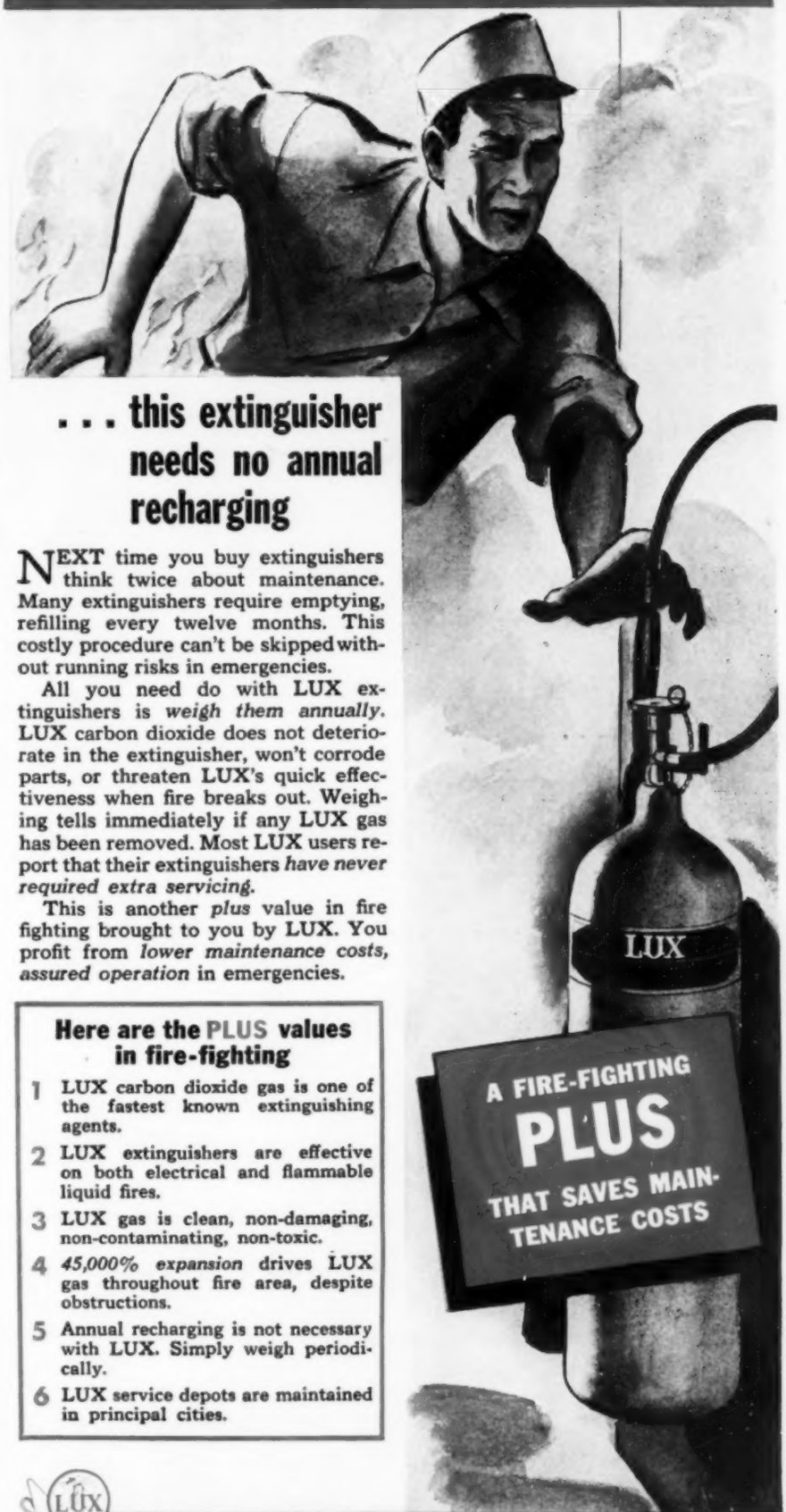

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A washable protective covering for flat wall paint has recently been developed by The Bergonize Co., Chicago, Ill. The product is designed for use in laboratories and plants where it is desirable to provide easy cleaning of painted walls. This material should simplify maintenance.

NEW ORGANIC CHEMICALS

Commercial availability for the first time of 2, 3-hydroxy methoxy benzaldehyde is announced by the Organic Chemicals Division of Monsanto Chemical Co., St. Louis. The compound undergoes the usual aldehyde reactions and suggests possible uses as an antioxidant and as an intermediate in chemical synthesis. The material is a yellow crystalline solid having a crystallizing point of 40 deg. C. At 50 deg. C. it has a density of 1.20, which is the equivalent of 10 lb. per gal. Two other new products announced by Monsanto which are of interest as chemical intermediates are, 2, 3-dimethoxy benzaldehyde (ortho veratraldehyde), and 2, 2'-diamino diphenyl disulphide. These are at present available only in experimental quantities, although the possibility of commercial production is anticipated. At room temperature 2, 3-dimethoxy benzaldehyde is a yellowish brown fused crystalline solid. It has a crystallizing point of 47.5 deg. C. and is almost completely soluble in sodium bisulphite. Specific gravity is 1.117 at 60 deg. C., equivalent to approximately 9.3 lb. per gal. Its chemical characteristics are similar to those of 2, 3-hydroxy methoxy benzaldehyde and it indicates possible use as a perfume fixative as well as intermediate. 2, 2'-diamino diphenyl disulphide is a powder of greenish yellow color. It melts between 86 deg. C. and 93 deg. C. and has a molecular weight of 288.

PROTECTIVES AND PRESERVATIVES FOR MATERIALS

A complete range of products for the protection and preservation of materials used in manufacturing, known as the Tocol line, are being offered by the newly organized firm of Protective Coatings, Inc., of Detroit. The line includes complete rubber insulation as well as 35 products for the protection of building structures, metals used in production and for the protection of many types of materials against the ravages of the elements: water, sun, acids and alkalis, as well as general wear. Aquanil, a non-oxidizing waterproofing material for concrete, stone, wood, brick and metals, is one of the members of this group. Others are Deox, a conditioner for all metals; Helfyr, a coating that resists temperatures to 3,000 deg. F. and used principally for refractory linings; and Volcazite which protects metals against all forms of corrosion.

SYNTHETIC WAX

A new synthetic wax made entirely from domestic raw materials that are freely available, has been developed by the Glyco Products Co., Brooklyn, N. Y. This wax known as Wax S324, is a hard, light-colored wax with a melting range of 103–106 deg. C. It is soluble in most oils and hydrocarbon solvents. It forms gels in the cold with mineral spirits, mineral oil and toluol. It is soluble in the cold in ethyl acetate. Wax S324 is compatible with most waxes and resins. It is recommended as a flatting agent for paints, varnishes and lacquers. Wax S324 is of considerable interest in this connection, because of its compatibility with solvents. A stockgel can readily be made which can be added to the varnish as desired in the cold, thus avoiding the lengthy and expensive grinding necessary with most flatting agents. Because of the fact that Wax S324 forms stable gels with various solvents, it is of considerable interest for the manufacture of paste polishes, overcoming sweating of the solvent. It is also of interest in the manufacture of record waxes, insulating waxes, etc.

PRESERVATIVE FOR FLOORS

In developing Penetex penetrating preservative for wood floors, the Truscon Laboratories, Detroit, Mich., presents a real streamlined material which not only makes a better looking wood floor but a better-wearing floor as well. It is said that Penetex cannot scuff off or chip off because it is in the wood. It is adaptable to all kinds of wood floors; plank, parquet, tongue-and-groove. It not only preserves the top, but also preserves the floor as far as it penetrates.

SYNTHETIC DETERGENT

A synthetic detergent called Triton 720 and described as "an aqueous paste of a sulphonated ether salt" is announced by Rohm & Haas Co., Philadelphia, Pa. It is said to have a wide field of usefulness in general cleaning compounds such as car-washers, floor- and wall-cleaners, rug shampoos, marble cleaning compound, etc. In cleaning compounds of various types, very low concentrations of 720 have improved its cleansing and emulsifying properties and made rinsing faster and more complete.

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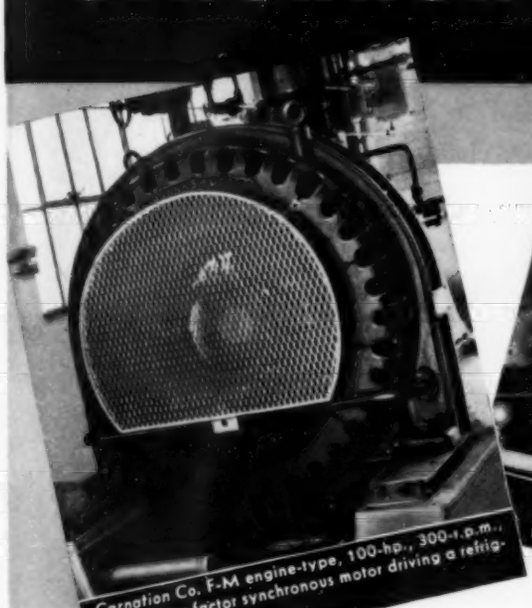
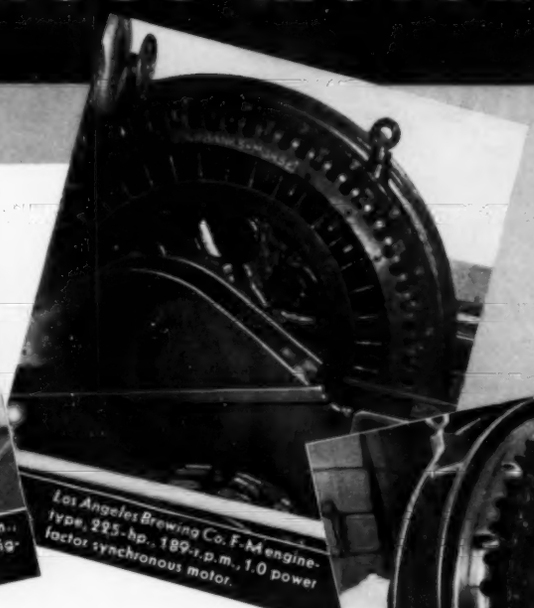


Carnation Co. F-M engine-type, 100-hp., 300-r.p.m., 80% power factor synchronous motor driving a refrigerating compressor.



Los Angeles Brewing Co. F-M engine-type, 225-hp., 189-r.p.m., 1.0 power factor synchronous motor.

Golden State Co., Ltd. F-M engine-type, 250-hp., 257-r.p.m., unity power factor synchronous motor driving an ammonia compressor.

Monarch Brewing Co. Two F-M engine-type, 100-hp., 277-r.p.m., 1.0 power factor synchronous motors driving 10×10 compressors.

Here Are
FOUR WITHIN 1/2 MILE
in Los Angeles!

Fairbanks-Morse not only builds synchronous motors, but builds them to high standards of performance for all types of applications. That's why in industrial areas everywhere you'll find concentrations of F-M Synchronous Motors like the group in Los Angeles, pictured here. For the story of the service these motors give is passed on . . . and *acted upon*. To get complete information on F-M Synchronous Motors—the only ones with *boltless, nutless, and threadless* stator frame—write Fairbanks, Morse & Co., Dept. J19, 600 S. Michigan Ave., Chicago, Ill. Branches and service stations throughout the United States and Canada.

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PUMPS FAIRBANKS SCALES WATER SYSTEMS FARM EQUIPMENT AIR CONDITIONERS

A Versatile NP Derivative

2-AMINO-2-METHYL-1-PROPANOL

$CH_3C(CH_3)NH_2CH_2OH$

Especially useful in SYNTHESIS

The usefulness of Amino-methyl-propanol as an emulsifying agent has tended to obscure the value of this compound for chemical synthesis. It will react readily with carbon disulfide, inorganic acids, acetic acid, higher fatty acids, aliphatic aldehydes, and other reagents, to form useful addition compounds. It is employed in the preparation of resins, wetting agents, pharmaceuticals, dyestuffs, and photographic developers.

Amino-methyl-propanol has a relatively high boiling point, 165°C., and low combining weight, 89.14. It reacts readily with higher fatty acids to form soaps. These soaps are practically odorless and have proved to be among the most powerful emulsifying agents known today.

A careful investigation of this NP derivative will be well worth your while. Two related Aminohydroxy compounds—Amino-butanol and Amino-ethyl-propanediol—also deserve your attention. A request on your letterhead will bring you a sample of any of these compounds.

PROPERTIES

Molecular weight	89.14	pH at 20° C. of 0 1 M solution	11.27
Melting point	25° C. to 26° C.	Vapor pressure at 20° C.	approx. 1 mm
Boiling point	165° C. at 760 mm	Flash point (open cup)	159° F.
Specific gravity	0.934 at 20° C./20° C.	Index of refraction at 20° C.	1.449

COMMERCIAL SOLVENTS
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A.I.Ch.E. To Meet at Virginia Beach

Outstanding feature of the annual meeting of the American Institute of Chemical Engineers on November 3-5, other than technical papers, will be a symposium on "Mobilizing Engineering Materials for National Defense" at which representatives of industry and government will discuss current shortages of chemicals, metals and petroleum products. Means of increasing production, conserving available supplies, finding substitutes, simplifying operation and production will be discussed.

American Gas Association, meeting at Atlantic City October 20-22, will have a novel 2½ day, "streamlined" session (without social functions) with panel discussions devoted 100 percent to national defense problems. Other than its usual large selection of technical papers, the American Petroleum Institute, convening in San Francisco, plans to feature an address by Petroleum Coordinator Ickes.

WITH THE ANNUAL FALL CONVENTIONS of the American Chemical Society, T.A.P.P.I. and the Electrochemical Society successfully over, the editors of *Chem. & Met.* now realize that there was enough technical information released at these meetings to keep all serious chemical engineers occupied for some time. But for those who were unable to attend these sessions or who missed certain papers of particular interest, some of the topics presented have been abstracted in these columns. Among those included in this issue are the following:

- Present status of synthetic rubber in American defense
- New source of strategic chlorine and salt cake
- Improvements in machinery for cooling ammoniated fertilizers
- Why catalytic cracking raises the octane number of gasoline
- Alkylating aromatic hydrocarbons
- How to produce potassium permanganate from ferro-manganese
- Making a fertilizer out of waste sulphite liquor
- Plant hormones—a new chemical industry
- New organic pesticides give promising results
- Process for continuous wood hydrolysis improves over German methods
- How to use filter-aids in refining sugar
- Operating conditions for iron plating baths
- New process can make soap in fifteen minutes
- How to protect your plant by proper lighting
- Research on nicotine creates new industries

NEW SOURCE OF CHLORINE AND SALT CAKE

INCREASED DEMAND FOR CHLORINE and salt cake has emphasized the need for new sources of these materials, reported A. W. Hixson and A. H. Tenney of Columbia University before the American Chemical Society in Atlantic City. By anhydrous reaction of SO_3 on salt a compound is formed which, when heated, offers a means of producing sodium sulphate and chlorine simultaneously from cheap chemicals. Heat generated by burning sulphur or by the reaction of SO_3 on salt is greater than the amount needed to produce the salt cake and Cl_2.

Previous work on the several reactions involved has been inadequate, reported the authors. Chemistry of a portion of the process may be outlined as follows, based upon laboratory work:

1. Sodium chloride and gaseous SO_3 react to form addition compounds of 1, 2 or perhaps 3 mols of SO_3 per mol of NaCl. This reaction is impeded by crust formation.
2. The higher addition compounds are unstable at room temperature. Above 115 deg. C. the compound $NaCl.2SO_3$ decomposes to SO_3 and $NaSO_3Cl$.
3. Between 225-300 deg., three mols of sodium chloro-sulphonate liberate one mol each of Cl_2 and SO_2.
4. The solid residue of this reaction is empirically an equimolar mixture of $Na_2S_2O_7$ and NaCl which reacts to form Na_2SO_4, Cl_2, and SO_2 above 330 deg. C.

Reaction kinetics of 3 and 4 were investigated by the authors and reaction orders and rate constants determined at several temperatures.

COOLING AMMONIATED FERTILIZERS

MECHANICAL IMPROVEMENTS IN MACHINERY for the cooling of ammoniated fertilizers were announced in a paper presented before the American Chemical Society by E. F. Harford of E. I. duPont de Nemours & Co. The author reviewed the operations of rotary coolers now installed, and said that these have an annual capacity of 400,000 tons per season, cooling fertilizer to approximately 100 deg. F. Units now being installed include louvers for distributing the air more uniformly over the cooler shell cross-sections, an improved inlet breeching and dust collector and an automatic discharge valve.

In very cold weather, reported Mr. Harford, if the air-to-material ratio is not maintained at five cu.ft. of air per lb. of material or above, then the relative humidity of the exit air becomes so high that moisture condenses on the walls of air ducts and the cyclone dust collector. Increasing the air volume lowers the relative humidity and tends to prevent condensation. A number of tests run on rotary dryer-type apparatus for cooling ammoniated fertilizers demonstrated that the stability of ammoniated mixtures is greatly increased by cooling and that at low temperatures the reversion reactions become so slow as to lose significance in normal storage periods.

PERMANGANATE FROM FERRO-MANGANESE

FOR NEARLY 40 YEARS ATTEMPTS have been made to prepare permanganate by anodic solution of ferro-manganese in a diaphragm-free cell. According to Antoine Lowry of Mondane-Fourneaux, France, before the Electrochemical Society in Chicago, several electrochemical plants have tried this process without success. For unknown reasons, the anodes used had a tendency to become passive and would fail

CALENDAR

OCT. 19-24.	**American Welding Society, 22nd annual meeting, Bellevue-Stratford Hotel, Philadelphia, Pa.**
OCT. 20-22.	**American Gas Association, annual convention, Atlantic City Auditorium, Atlantic City, N. J.**
NOV. 3-5.	**American Institute of Chemical Engineers, annual meeting, Cavalier Hotel, Virginia Beach, Va.**
NOV. 3-7.	**American Petroleum Institute, 22nd annual meeting, St. Francis and Palace Hotels, San Francisco, Calif.**
DEC. 1-6.	**18th Exposition of Chemical Industries, Grand Central Palace, New York, N. Y.**

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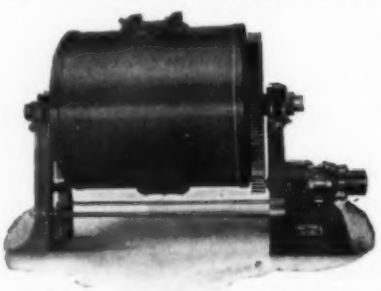

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to dissolve. In some cases they would become covered with a layer of manganese dioxide, the current density would drop, the potential rise, and the production of permanganate would not only cease but that already produced would be largely decomposed into manganese dioxide.

The author investigated the process and empirically determined optimum conditions. Results indicate that it is possible to prepare a commercial grade of permanganate by anodic solution of ferro-manganese, providing conditions for operating the cell are relatively rigid. The author stated that electrolytically prepared permanganate is cheaper than that made by the older straight chemical processes.

It was found to cost more to produce $KMnO_4$ by electrolysis directly than first to produce sodium permanganate and then convert this to the potassium salt by double decomposition with KCl. Recommendations for commercial production of $KMnO_4$ were as follows:

Electrolyte: solution of 200-220 g. of NaOH per liter.
Anodes: ferro-manganese containing 70-75 percent Mn and 5-6 percent carbon.
Cathodes: copper or iron tube helix, water-cooled.
Current concentration: 12-25 amp. per liter.
Current density: 15-30 amp. per sq. dm. at the anode and 5-10 amp. per sq. dm. at the cathode.
Bath temperature: 10 deg. C.
Duration of electrolysis: 3-4 days.

The end of each individual cell run corresponds to near-saturation of the electrolyte with sodium permanganate. The cell voltage has then risen to 5-6 v., as against 3-3.5 v. during the first day's operation of a freshly charged cell. A little NaOH solution is added so that at the end of the third or fourth day there may still be at least 40 g. per litre in the bath. Upon completion of the run, the cell solution is decanted, treated with chlorine and then with air to expel excess chlorine. Next $KMnO_4$ is precipitated by addition of KCl to the solution.

Average current efficiency of the cell is about 25 percent, and the net energy consumed, on the basis of solid, dry $KMnO_4$ crystals, is about 25 kw.hr. per kg. of $KMnO_4$. The conversion of the manganese in the ferro-manganese anodes is relatively high. However, considerable NaOH is lost by conversion to carbonate and chloride.

NEW ORGANIC PESTICIDES

HIGHLY PROMISING RESULTS from the experimental use of dithiocarbamic acid derivatives as pesticides were reported to the American Chemical Society by W. H. Tisdale and A. L. Flenner of the Pest Control Laboratory of E. I. duPont de Nemours & Co. Tetramethylthiuram disulphide has been found highly effective for repelling the Japanese beetle, while in more recent field work ferric dimethyl dithiocarbamate was found to be of equal, if not superior value. In addition to its high potency as a fungicide,

it adheres to fruit and foliage unusually well without added assistants.

Tetramethylthiuram monosulphide is effective against fungi causing human skin infections, and also against certain mites. Certain metal dithiocarbamates, including the sodium, iron, calcium and manganese salts, have high fungicidal value. None are stomach poisons but many are contact poisons. The U. S. Golf Association Greens Section found tetramethylthiuram disulphide most effective of more than 100 chemicals in the control of such turf diseases as "dollar spot" and "brown patch." Four ounces per 1000 sq.ft. resulted in complete control. Considerable promise is held for the use of dithiocarbamic acid derivatives as seed and soil disinfectants.

WASTE SULPHITE LIQUOR FERTILIZER

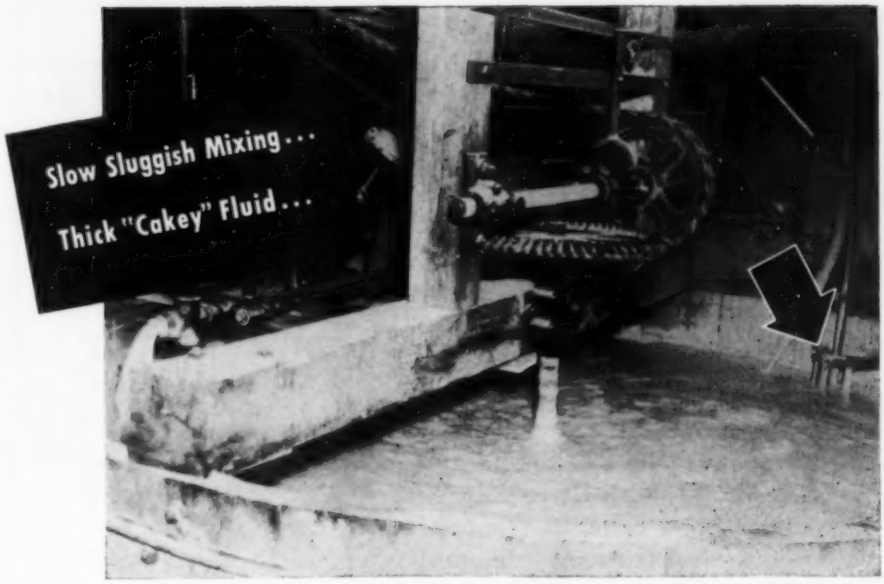
PLANT GROWTH STUDIES HAVE BEEN made with soil to which various quantities of waste sulphite liquor from Northwest paper and pulp mills have been added, reported W. E. Caldwell, J. B. Spulnik, and A. Vane of the Oregon State College, Corvallis, before the American Chemical Society in Atlantic City.

Waste sulphite liquor has been shown to supply sulphur in sulphur-deficient soils, and analyses have been made on numerous liquor samples for the amount of potassium present. Hot waste sulphite liquor as it comes from a mill will dissolve an appreciable amount of powdered raw rock phosphate. Tests were also conducted to determine the nitrogen that can be incorporated into waste liquor as ammonium nitrogen and as organic nitrogen by addition of aqueous ammonia and of ammonia under pressure. Trace elements of the wood would be in the sulphite leachate.

More important than the inorganic elements is the organic lignin-resin material as a precursor to soil humus. Experiments are now under way on a two-acre plot near a pulp mill, where the pulp company, during low-water time when stream pollution is highest, wishes to dilute the waste sulphite liquor with nine parts of pulp wash water and give it to surrounding farmers for irrigation purposes.

APPLICATIONS OF PLANT HORMONES

NEWER APPLICATIONS OF PLANT HORMONES, reported F. D. Jones, American Chemical Paint Co., before the American Chemical Society, are concerned with such properties as inhibition of growth and stimulation of growth, whether by spraying, dusting, or soaking. Because of stability, method of preparation, and high activity, naphthalene acetic acid and naphthalene acetamide are chiefly used in preventing harvest drop of apples, pears, and plums. The acetamide is preferred because it is the least toxic as well as the most stable of all the synthetic hormones.



A *tough* pH *job—but* BECKMAN *Equipment Takes It In Stride!*

You don't have to "pamper" Beckman pH Equipment. Regardless of the color or viscosity of the process solution . . . regardless of suspended solids—or of oxidizing or reducing agents . . . Beckman pH Equipment asks no favors—gives *uniformly* accurate pH Control under the toughest operating conditions.

Beckman Immersion Assembly

Take the application shown above . . processing Tri-Sodium Phosphate. The problem here is to closely control the pH in the vat throughout this mixing operation. On the bottom end of the pipe indicated by arrow —*several feet below the surface of the fluid*—is a BECKMAN Immersion Type Electrode Assembly. The fluid in the vat is thick, sluggish, hard to control. Worse, it continuously builds a heavy cake on everything in the vat, including the electrodes.

Yet . . . in spite of this "cake"-forming tendency—and in spite of the thick, sluggish nature of the mix . . . . this Beckman pH installation maintains sensitive, *continuously accurate* pH control in the vat, giving day-in, day-out performance *with practically no maintenance—no interruptions.*

No Other pH Equipment Will Do These Jobs

Do You Have a Process Where High pH Values are a Factor?

Then remember—the Beckman High pH Glass Electrode is the *only* glass electrode that permits accurate pH control in highly alkaline solutions—*even in the presence of sodium ions*—a development important to many industries such as soap making, the manufacture of industrial cleaners, detergents, bleaches, etc.

Does Your Processing Require pH Control of High Temperature Solutions?

Then note this—the Beckman High Temperature Glass Electrode is the *only* one that permits continuous pH control in high temperature solutions up to 100° C. (212° F.) . . . indispensable for MANY industrial processes including sugar refining, boiler feed water conditioning, electro-plating, etc.

Beckman *Automatic* pH Indicator

These are only TWO of MANY Important pH Advancements available in Beckman equipment—exclusively.

Before you buy *any* kind of pH equipment—either *portable* for plant and field use . . . or *automatic* for large scale process control—investigate the advanced features found *only* in BECKMAN pH Equipment. There's a size and type of Beckman instrument for every application.

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Berl saddles are made in the ¼", ½", 1" and 1½" sizes of chemical stoneware, porcelain or semi-porcelain; all acid-proof, tough, non-spalling materials.

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High basket speeds of Fletcher Centrifugals turn out more work per hour. To close the gap between production and demand you need *fewer new centrifugals*—if they're Fletchers! Your investment is less, and so is cost of housing and installation—and you're protected against possible over-expansion when the rush is over. *Ask about them; all details on request. No obligation.*

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Sprays of naphthalene acetamide on citrus trees have produced two weeks' earlier maturity of fruit. Both naphthalene acetic acid and acetamide have been used in ratios of 1:10,000 in sprays for inhibiting bud development of peach, pear and plum. Even 1:10 ppm. sprays of acetamide on normally pollinated flowers of alfalfa, cotton, tomatoes, and beans have produced increases in sets of seed or fruit in "self-sterile" varieties.

Naphthalene acetamide and the methyl ester of naphthalene acetic acid inhibit sprouting and depress respiration of potatoes in storage. Treatment of seed with either naphthalene acetic acid or acetamide produces improvement of germination, faster growth, and larger crops. Tomato, tobacco and cabbage plants treated with naphthalene acetamide have suffered less wilt and transplant set-back, thus giving larger crop yields.

NEW METHOD FOR MAKING SOAP

TO MAKE A BATCH OF SOAP by present methods requires from 3-7 days, according to J. J. Jacobs of the Polytechnic Institute of Brooklyn, before the American Chemical Society. The author described laboratory work on a novel method for making soap which requires approximately 15 min. A feature of the new process is the complete elimination of the necessity for using water. The fat is dissolved in kerosene and heated to 180 deg. C. Solid lye is added and the temperature is then brought to 220 deg.

In the improved process, the lye reacts with the fat very rapidly, requiring something less than 15 min. This hot mass of soap and kerosene is then sprayed into a vacuum chamber (1-10 mm. of Hg). Here the kerosene and pure glycerine which is always formed in the manufacture of soap, flash off together, leaving a dry, granular soap. The kerosene and glycerine are condensed and separated by decantation. The kerosene can then be re-used. An outstanding characteristic of this process is that the glycerine recovered contains only 1-5 percent water. Up to 86 percent of the glycerine has been recovered. Except for very slight traces, the kerosene appears nowhere in the final products.

Indicated heat costs, outside of savings in time and labor, are about 1/20 those of present methods. The process is adaptable to the production of industrial soap and needs only slight modifications in order to produce high-grade toilet soaps. A small pilot plant unit has been built to study the effects of design of spray nozzles and other factors on recovery.

PROTECTIVE LIGHTING FOR PLANTS

PROTECTIVE LIGHTING FOR industrial plants, reported D. H. Tuck of the Holophane Company, Inc., New York, before a joint meeting of the American Institute of Electrical Engineers and the N. Y. Section of the Illuminating

Engineering Society, and published in the July issue of *Illuminating Engineering*, is a subject that during wartime has taken on added significance.

Fence Lighting — Fence lighting should enable the guard to see anyone loitering outside or attempting to get over and the requirement is 0.15-0.20 footcandle. For 25-ft. mounting height, 10,000-lumen lamps on 150-ft. centers will give 66 lumens per linear ft. or 0.25 footcandle, 6,000-lumen lamps spaced on 150-ft. centers will give 40 lumens per linear ft. or 0.15 footcandle, and 10,000 lumen lamps on 200-ft. centers will give 50 lumens per linear ft. or 0.19 footcandle. The relation between mounting height and glare shows that a 25-ft. mounting height is practical as the glare is reduced to a point where greater height only causes a slight reduction. The angle of maximum candlepower for uniform illumination is:

$$a = \tan^{-1} \times \frac{0.5 \text{ spacing}}{\text{mounting height}}$$

When spacing on centers is 200 ft. and mounting height is 25 ft., the angle of maximum candlepower should be set for 76 deg. The type of horizontal light distribution will depend to a large extent on local conditions. Good practice is to use an asymmetrical distribution of light, concentrating the major part along the fence.

First cost of fence lighting, including all material and labor, is approximately $4,000 per mile for overhead construction and wood poles. The cost of operation, based on current at one cent per kw.-hr. and 3,000 hr. burning per year is $400 per mile.

Gate Lighting—This should be well lighted as it is most important for the guard to recognize those who go in and out. In addition to a wide spread of light, there should be a down light at 30 deg. from the vertical and aimed at the center of the roadway. Lights near the entrance should be on a separate multiple circuit for additional reliability. Many plants are providing a diesel-engine generator set for emergency use.

Inside Lighting—These lights should be left burning all night and not turned on and off by the watchman as he makes his rounds. Approximately 0.25 footcandle is sufficient. For low bays, 200-watt lamps spaced on about 70-ft. centers and mounted approximately 12 ft. from the floor is good practice. For high bays, a spread-type, high-bay unit should be used. The spacing should be twice the mounting height and the lamp size selected to give about 1/25 watt per sq.ft. of floor area. For instance, a 300-watt lamp mounted 40 ft. above the floor in a spread-type, high-bay unit having an angle of maximum candlepower at 45 deg. and spaced on 80-ft. centers would be sufficient. In cases where 400-watt mercury lamps are used, it is desirable to have a stand-by of incandescent illumination.

For shipping platforms, 200-watt

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Doubtless there are spots in your plant where rubber rolls could be used to advantage, possibly to replace some other product needed for defense purposes. If so, write us. We'll give you the benefit of our experience of more than 50 years in the manufacture of rubber rolls.

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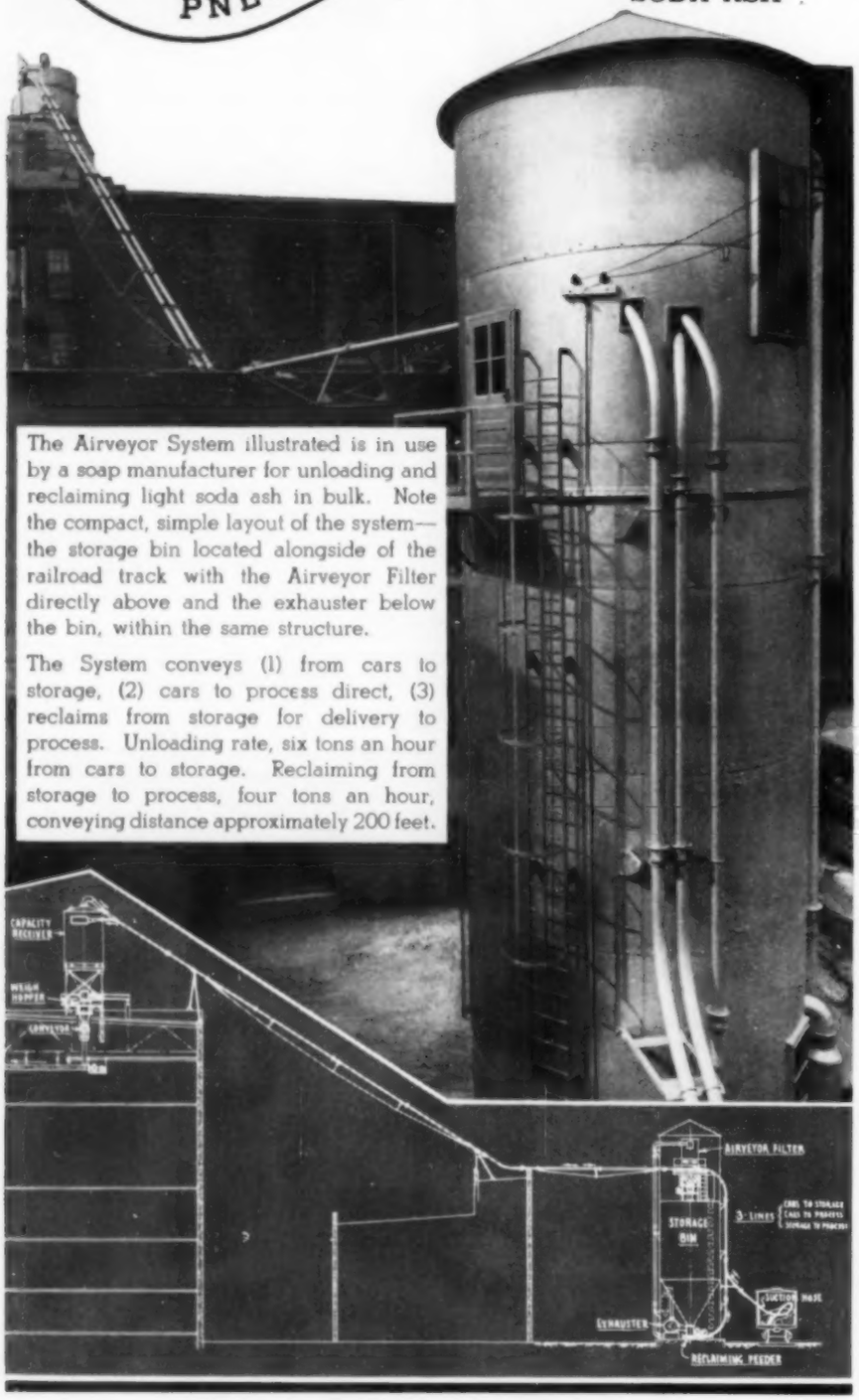
UNLOADING AND RECLAIMING SODA ASH



The Airveyor System illustrated is in use by a soap manufacturer for unloading and reclaiming light soda ash in bulk. Note the compact, simple layout of the system—the storage bin located alongside of the railroad track with the Airveyor Filter directly above and the exhauster below the bin, within the same structure.

The System conveys (1) from cars to storage, (2) cars to process direct, (3) reclaims from storage for delivery to process. Unloading rate, six tons an hour from cars to storage. Reclaiming from storage to process, four tons an hour, conveying distance approximately 200 feet.

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A-47

lamps should be mounted vertically on the wall about 12 ft. above the platform and spaced on 36 ft. centers. Illumination is approximately 2 footcandles.

NEW INDUSTRIES FROM NICOTINE

NICOTINE, AN IMPORTANT INSECTICIDE for many years, is derived from tobacco factory stems, scraps and other waste, and to a lesser extent from low-grade leaves of the heavy tobacco types. Approximately 75,000 tons of factory wastes annually yield nearly 800,000 lb. of nicotine alkaloid and an additional 200,000 lb. are secured from low-grade leaf tobacco. So report E. G. Beinhart and J. J. Willaman of the Eastern Regional Research Laboratory, U. S. Dept. of Agriculture, Philadelphia, in the *Catalyst*, publication of the Philadelphia Section of the American Chemical Society.

Fixed Nicotines—These recent developments promise to extend the market for nicotine. Prior to 1928 nicotine was used only as a contact insecticide for which purpose it was applied as a spray. In "fixed" nicotines the alkaloid is in a more permanent form and may persist for as long as 15 days. Fixed nicotines are equal to lead arsenate for control of the codling moth, but their cost is at least twice that of arsenate of lead. However, residues from nicotine sprays require for their removal only wiping of the fruit instead of the extensive washing usually required to remove lead arsenate.

Annual consumption of nicotine bentonite compounds has steadily increased from 400 lb. in 1936 to an estimated 100,000 lb. in 1941. The Eastern Regional Research Laboratory is endeavoring to develop "fixed" nicotine sprays which will persist on the trees for a longer time than do the present compounds and which will cost the grower but little more than arsenate of lead. Several fixed nicotine compounds are now being studied whose properties appear to meet these requirements.

Nicotinic Acid—In early 1941 it was recommended that white flour be fortified by the addition of nicotinic acid and the official standard is now 6-24 mg. of nicotine acid per lb. of fortified flour. In 1940 perhaps 10,000 lb. of nicotinic acid was manufactured for treatment and prevention of pellagra. It is estimated that 200,000 lb. will be required in 1941 for flour fortification and that requirements for pellagra therapy may reach 20,000 lb. If all the nicotinic acid required for the United States in 1941 were made only from nicotine, 17-20 million lb. of tobacco would be required.

Best known compounds from which nicotinic acid may be derived by oxidation are nicotine and two coal-tar products, quinoline and betapicoline. Nicotine, most costly of the three, appears to offer certain advantages in simplicity of manufacture and in purification of the reaction products. Nitric

acid is the simplest oxidation reagent, but for oxidizing the two coal-tar products $KMnO_4$ is preferred.

Quinoline is a product easily procurable at relatively low prices, but beta-picoline has not yet been produced in sufficient volume in the pure grade to assure dominance of the field that the simplicity of its reaction might indicate. The 200,000 lb. of nicotinic acid estimated to be required in 1941 for the breadstuffs industry alone represents nearly 500,000 lb. of nicotine alkaloid. This is equal to at least one-half the present consumption of nicotine for all uses.

Other Fields—Study of alkaloids other than nicotine, such as novnicotine, is opening an interesting field, especially from the insecticide standpoint. Research is being continued on cheaper methods of extracting the alkaloid as well as with activators to enhance the effectiveness of nicotine as an insecticide.

PRESENT STATUS OF SYNTHETIC RUBBER

INFORMATION ON THE PRESENT status of synthetic rubber was given before the American Chemical Society in Atlantic City by E. R. Bridgwater of E. I. duPont de Nemours & Co. It was pointed out that although polysulphide rubbers (Thiokol) and flexible, nonvulcanizable plastics (such as Koroseal and Vinylite, plasticized polyvinyl chlorides) could be substituted for rubber in many industrial applications, nevertheless there are important uses for rubber, such as for tire treads, for which these materials would not be satisfactory.

Hence the only complete available substitutes for natural rubber are the butadiene rubbers and neoprene. This is true of such uses of rubber as power transmission and conveyor belts and, in general, products that are subjected to severe mechanical stresses or to high temperatures. A stoppage of crude rubber imports would make our principal problem that of supplying adequate quantities of butadiene rubbers and of neoprene.

American synthetic rubber production in long tons was given as follows:

Year	Neoprene	Butadienes	Polysulphides
1939	1,750	None	500
1940	2,500	60	700
1941 (Est.)	6,300	4,000	1,400

Total production this year of general-purpose synthetic rubbers will be about 1.5 percent of crude rubber consumption.

By the end of 1942 this country expects to have a monthly capacity of about 1,600 long tons of neoprene and 900 tons of butadiene rubbers provided by privately financed enterprises. In addition, there will be four government plants for making the butadiene-styrene interpolymer which will have a combined capacity of 3,300 tons a month. Hence, by the end of 1942 there should be a total capacity of about 9,800 tons a month of these general-purpose syn-

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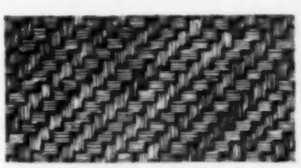

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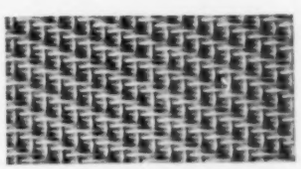
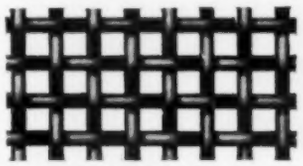


Dutch Weave Twilled Filter Cloth



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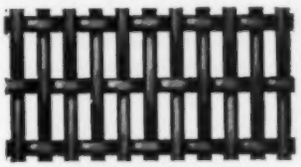

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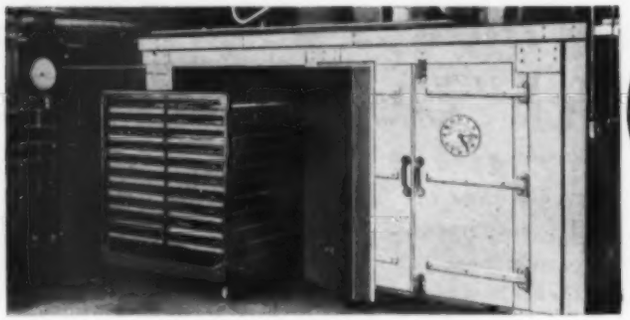

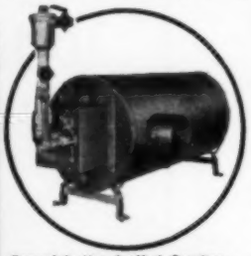

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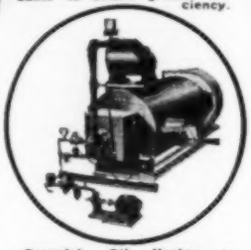

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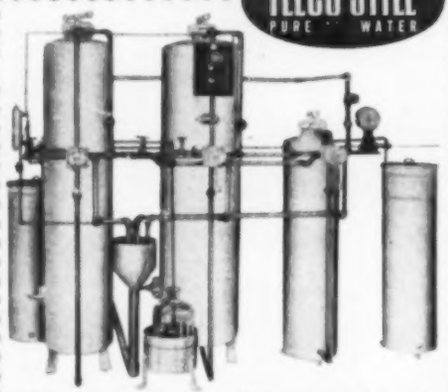

Operation — Water passes through two reactor tanks. A chemical reaction in first tank removes positive ions, such as calcium, magnesium, and iron, substituting hydrogen. Water then passes to second tank where the hydroxyl (OH) ion is substituted for negative chloride and sulphate ions, etc. This OH ion then combines with hydrogen to form H_2O. The minerals removed from water are retained in reactor tanks until flushed to drain. Treated water contains small amounts of dissolved carbon dioxide gas which can be dispelled easily by aeration.

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thetic rubbers. This is believed to be considerably greater than Germany's synthetic rubber capacity.

This figure does not include the polysulphide rubbers, which would be of great value if an emergency should arise because plants for producing them can be built more quickly and at lower cost than plants for the butadiene rubbers and neoprene. Neither do the figures given include the plasticized polyvinyl chlorides. Plants under construction, which will be completed in the spring of 1942, will bring capacity for these to 900 tons a month of unplasticized resins—equivalent to about 1,500 tons of finished products. In addition, it is expected that there will be capacity for producing about 400 tons a month of butyl rubber.

To provide synthetic rubber equal to 30,000 tons a month or half of our present natural rubber consumption, a total investment in facilities for providing raw materials, power, and other services of half a billion dollars might be required. To obtain such a sum would perhaps not be difficult, but to provide the skilled labor, highly-specialized equipment, and construction materials would obviously require serious sacrifices in other directions.

CONTINUOUS WOOD HYDROLYSIS

A CONTINUOUS PROCESS FOR the hydrolysis of wood with dilute acid has been developed which results in the production of lignin and lignocellulose for plastics as well as acetic and formic acids, furfural, and wood sugars. This process eliminates to a great extent the major problems encountered in batch processes, both those using concentrated acids (such as Bergius') and those using dilute acids (such as Scholler's). The process is applicable to wood wastes in the form of wood flour, sawdust, or small chips, according to R. Katzen and D. F. Othmer of the Polytechnic Institute of Brooklyn, before the American Chemical Society.

Wood materials are suspended in a quantity of dilute acid, such as H_2SO_4, sufficient to permit a free-flowing suspension, which is pumped continuously under pressure into a double pipe heat interchanger in which preheating, hydrolysis, and cooling occur. The hydrolyzed suspension is discharged by means of an electrically operated relief valve to a receiver at atmospheric pressure. Filtration, washing, drying and grinding follow standard practice.

Degree of hydrolysis can be controlled so as to yield a ligneous product containing from nearly all the cellulose present in the original wood to practically no cellulose. Major factors governing the degree of hydrolysis are: pressure, temperature, acid concentration, and time. Hydrolysis liquors which contain acetic and formic acids, furfural and wood sugars, in addition to the H_2SO_4 originally used, may be recycled for re-use in hydrolysis. If subjected to rehydrolysis, some of the sugars break down to

give additional organic acids and furfural. These byproducts are obtained in high yields and are readily and economically recovered by extraction and distillation.

Major advantages of the continuous process include (1) accelerated hydrolysis (1-10 min. as compared with 30 min. to 6 hrs. for batch processes), due chiefly to improved heat transfer; (2) better control of operating variables; (3) low steam cost due to heat interchange and elimination of blowdown; and (4) low equipment and operating costs due to simplicity of equipment and reduction in handling of materials, labor and supervision.

A pilot plant is now producing commercial quantities of lignocellulose molding compound for manufacture of plastic articles from wood flour or sawdust, according to the authors. The new process was developed by the Northwood Chemical Co. of Phelps, Wis. The compound competes on a price basis with inexpensive plastics on the market and offers promise of considerably lower cost in the future.

FILTER AIDS IN SUGAR REFINING

IN THE CANE SUGAR INDUSTRY, the filters generally accepted are of the Sweetland and Vallez types, although the conventional plate and frame filters are still in use, reported A. S. Elsenbast and D. C. Morris, Johns-Manville Sales Corp., New York, before the American Chemical Society.

Precoating calls for proper selection of kind and quantity of filter-aid, concentration of filter-aid in the precoating vehicle, and speed of circulation. Consideration must be given to whether once-filtered or unfiltered liquor is used, and the incorporation of air should be avoided, especially with low-purity liquors. In the pressure liquor cycle, choice and amount of filter-aid are important, but also pressure, temperature and pH control must not be overlooked.

Use of filter-aids in plate and frame filters of the conventional design with bottom corner discharge, interior or exterior, is usually less efficient than in filters of the shell type. Conversion of such plate and frame filters to top discharges has largely corrected the difficulty, but in using these filters, greater attention must be paid to temperature control in order to minimize radiation losses and maintain the liquid in a good fluid condition.

Filter-aid filtration in beet sugar factories has become universal, plate and frame filters generally being used. In recent years many of these have been converted to top discharge in order to obtain a more even precoat, a more even cake deposition, shorter circulation time to reach the desired clarity, and complete thermophile removal. Filter-aid clarification in the beet sugar factory is chiefly confined to liquors going to the white sugar pans, though high wash and high green are sometimes separately filtered. Filter-aid filtration of these liquors not only

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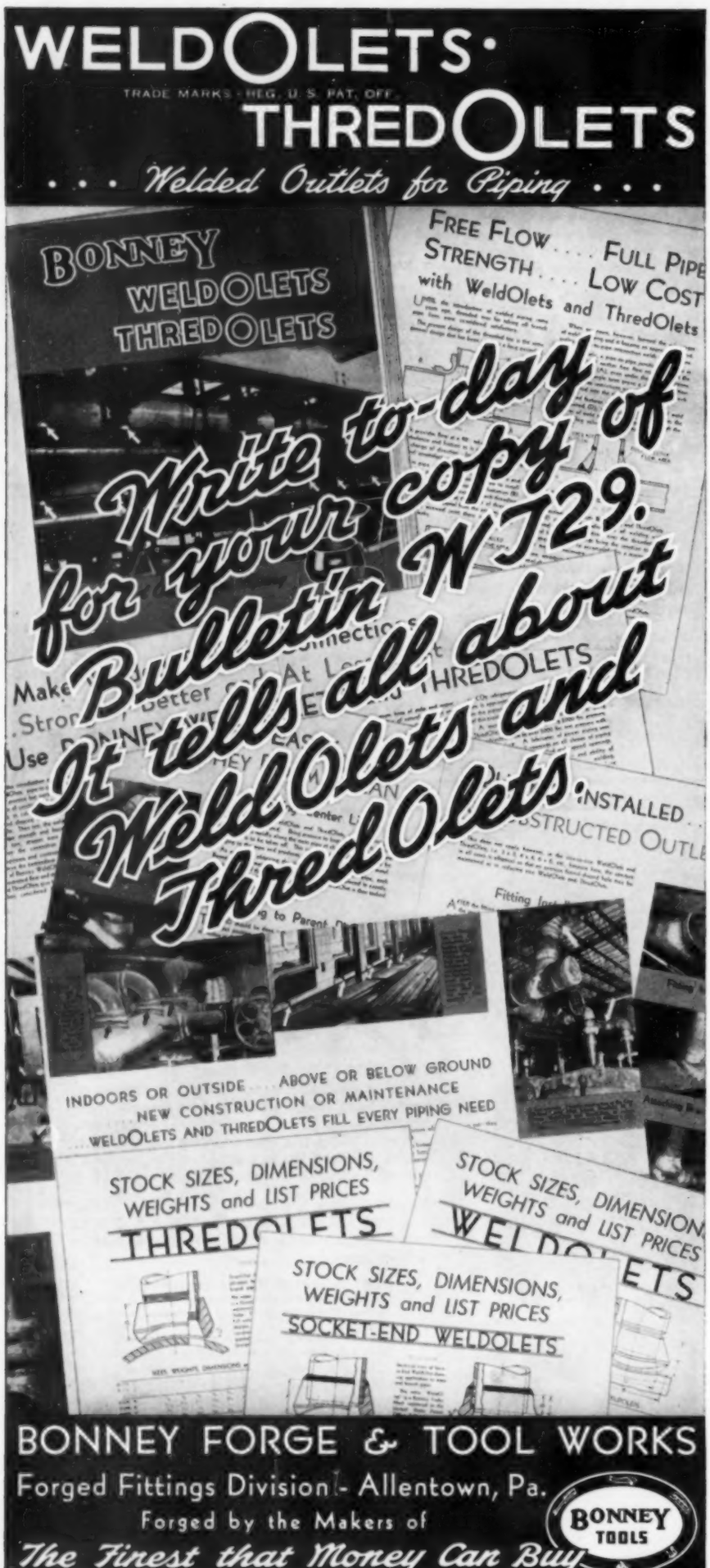
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CATALYTICALLY CRACKED GASOLINE

COMPOSITION OF CATALYTICALLY cracked gasoline, a subject which has given rise to much speculation since the advent of commercial catalytic cracking of petroleum by the Houdry process, was discussed before the American Chemical Society by J. R. Bates, S. S. Kurtz, Jr., F. W. Rose, Jr. and I. W. Mills of the Sun Oil Co., Marcus Hook, Pa. It has been known that catalytically cracked gasolines have a high octane number as compared to those produced by thermal cracking and those occurring in nature as straight-run gasolines.

Work by the authors has shown that this high octane number of catalytically cracked gasoline is due to (1) the presence of an overwhelming excess of isoparaffins, which have high octane ratings, over normal paraffins in the lower boiling portions of the gasoline and (2) to a high content of aromatic compounds in the higher boiling fractions. The olefin content of catalytic gasolines can be varied widely, with only a secondary effect on fuel quality. Another interesting fact discovered was that although natural and thermally cracked gasolines have a lower isoparaffin content than that calculated by thermodynamics, the catalytically cracked gasolines have a higher content. This was reported to be due to cracking under conditions of non-equilibrium.

These data show that the superior quality of gasoline catalytically cracked by the Houdry process is due to difference in composition of hydrocarbons.

ALKYLATION OF AROMATIC HYDROCARBONS

AROMATIC HYDROCARBONS, such as benzene and toluene, have been alkylated with olefins at temperatures of 800 deg. F. and above, reported A. N. Sachanen and A. A. O'Kelly of the Socony-Vacuum Oil Co. before the American Chemical Society in Atlantic City. This process, reported the authors, was performed under atmospheric pressure and in the absence of catalysts, but high pressures and such catalysts as activated clay improved the yields of alkyl aromatics. Toluene is more easily alkylated at these temperatures than benzene. On the other hand, propylene and butylene are stronger alkylating agents than amylene.

Under high temperatures the alkyl aromatics produced were partially cracked, forming those of lower molecular weight. As a result, alkyl aromatics formed were composed of an entire series beginning with toluene and increasing in molecular weight. The aromatics produced contained 90 percent or more of purely aromatic hydrocarbons.

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HIGH PRESSURE REDUCTION

IN REDUCING fatty acid amides to the corresponding amines a good result can be obtained by operating under high pressure, preferably between 180 and 200 atm. at 250 to 270 deg. C. With dioxan as solvent and a copper-chromium oxide catalyst the principal product is a secondary amine, e. g. dioctyl and didecyl amines from caprylic and capric amides respectively, or dicetyl amine from palmitic amide. Under the stated conditions reduction can be completed in about 30 minutes. A small amount of a barium promoter in the copper-chromium oxide catalyst is a useful aid to rapid and complete reduction. At least three times as much dioxan as acid amide should be used as the reaction medium. A small autoclave, arranged for mechanical shaking during the reaction, is suitable. At the end of the reduction the mixture is filtered. Secondary amines are recovered from the filter cake and primary amines form the filtrate.

Digest from "High Pressure Reduction of Fatty Acid Amides," by S. Ueno and S. Takase, *Journal of the Society of Chemical Industry, Japan*, 44, 29B, 1941. (Published in Japan.)

SUBLIMED LEAD OXIDES

ULTRAMICROSCOPIC crystallographic examination of sublimed red lead shows a definite crystalline structure, now revealed for the first time. This confirms x-ray diagrams which reveal crystal interferences in the diagrams for red lead. All other methods of examination have indicated this pigment to be isotropic and it was so considered hitherto. The crystal form has not yet been positively identified, but it is known not to be cubic, rhombic or triclinic. In all probability it is tetragonal. The studies were made with primary particles of sublimed red lead, made by vaporizing lead in an electric arc and burning the vapor in oxygen. Similar studies of litharge, lead suboxide and lead peroxide are in progress.

Digest from "Morphology of Extremely Fine Sublimed Lead Oxides," by R. Meldan and M. Teichmüller. *Zeitschrift für Elektrochemie* 47, 95, 1941. (Published in Germany.)

INFRA-RED DRYERS

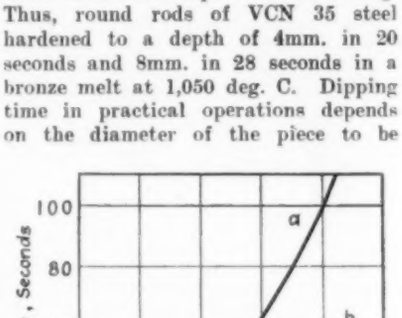
DRYING with infra-red rays, adopted first by Ford Motor works for baking lacquers, is a highly efficient method. Penetration is particularly good in urea: formaldehyde resins but is also ample for baking finishes made with other resins. Infra-red irradiation of synthetic resin sheets for 15 minutes gives the same effect as an hour in a drying oven at 150 deg. C., and deformation due to uneven drying is avoided. Excellent results are also obtained in drying small molded articles, but thin foils are too transparent to the rays for satisfactory drying. Hard rubber (unpigmented) can be dried with infra-red light, but if pigmented with carbon black it is opaque.

Among the materials which are more easily or effectively dried by infra-red rays than by ordinary methods are cable insulation, motor windings, rubberized fabrics, resin-impregnated paper or paperboard and paper or fabric impregnated with fatty oils. For this last purpose a combination of infra-red and ultraviolet irradiation gives an excellent effect, in that the infra-red rays accelerate drying while the ultraviolet rays promote polymerization of the oil.

Digest from "Infrared Rays and Industrial Drying," by Maurice Deribere, *Chimie et Industrie* 45, 541, 1941. (Published in France.)

DIP HARDENING

HARDENING by brief immersion in a salt melt is a new process which is applicable to any steel now hardened by the torch method, and often the results are superior to torch hardening. The method comprises dipping the metal in a melt of $BaCl_2$ and KCl or of tin bronze at 1,100 deg. C. until hardening penetrates to the desired depth. The metal is then quenched. Dipping time varies according to the steel and the depth of hardening. Thus, round rods of VCN 35 steel hardened to a depth of 4mm. in 20 seconds and 8mm. in 28 seconds in a bronze melt at 1,050 deg. C. Dipping time in practical operations depends on the diameter of the piece to be



treated. Diameter-time curves are shown in the diagram for 3 melts: a) $BaCl_2$:KCl at 1,100 deg.; b) cast iron melt at 1,250 deg.; c) tin bronze melt at 1,100 deg.

Digest from "Dip Hardening" by H. Ruhfus and Klärding, *Zeitschrift des Vereins deutscher Ingenieure* 85, 486, 1941. (Published in Germany.)

IMPROVED ELECTRON MICROSCOPE

AN ATTACHMENT which permits a selective electron beam to be directed against a small specified area in the field has increased the range of utility of elecron microscopes in examining a

wide variety of materials. As an example the study of zinc oxide crystals is cited. Given a zinc oxide pigment specimen, on a nitrocellulose foil as support, a single crystal in the field can be selected for closer examination. An electron beam only one micron wide may be focused on the selected crystal and a separate exposure may be made which brings out clearly the structure of the crystal.

This effect is achieved by interposing a condenser, with very short focal length, in an electron microscope. The beam focused through this condenser gives a small seperate diffraction diagram by means of which many structures may be studied which are far below the resolving power of any optical microscope. These separate diffraction diagrams give better definition than has hitherto been obtained with the electron microscope alone, so that this instrument becomes even more useful than before in exploring units of matter which cannot be seen with optical microscopes.

Digest from "Electron Microscope With Interposable Selective Electron Beam for Making Diffraction Diagrams of Specified Small Areas in the Field of Vision," by Manfred von Ardenne, *Zeitschrift für Physik* **117**, 515, 1941. (Published in Germany.)

THERMAL EXPANSION OF ALUMINUM

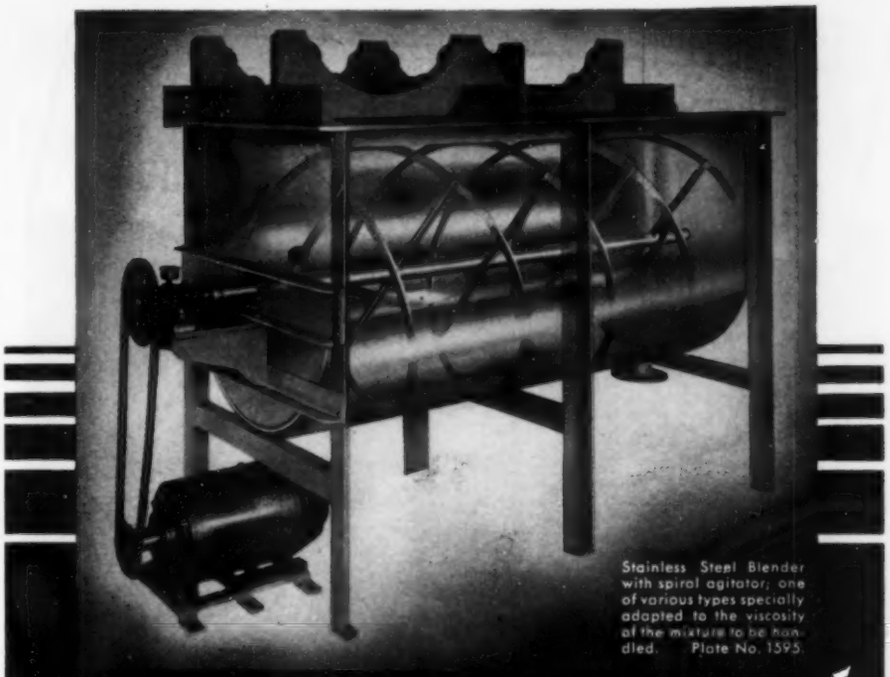
AT HIGH temperatures aluminum does not closely follow the rule that coefficient of expansion is equal to a constant times specific heat. The coefficient of thermal expansion of pure aluminum has been measured accurately by the new technique in which a high temperature x-ray camera is employed. The results are accurate within 1 to 2 percent even at high temperatures. Measurements were made at intervals up to 650 deg. C. Results are shown in the table.

Temperature deg. C.	Specific Gravity	Coefficient of expansion X 10^6
0	4.0391	22.0
100	4.0486	25.4
200	4.0592	26.5
300	4.0701	27.8
400	4.0820	29.9
500	4.0947	32.5
600	4.1087	35.5
650	4.1162	37.2

Digest from "Thermal Expansion of Aluminum From 0 to 650 Degrees C.," by A. J. C. Wilson, *Proceedings of the Physical Society* **53**, 235, 1941. (Published in England.)

USE OF X-RAYS IN METALLURGY

THE MOST widely publicized use of x-rays in metallurgy is in detecting hidden defects or faulty welds, but equally important progress is being made in the practical applications of crystalline structure studies. The first essential in this field was to determine the crystal structure and lattice dimensions of pure metals. A remarkable discovery made by this method is that delta iron is actually not another form but is merely alpha iron in a higher range of thermal stability. The x-ray method also permits accurate measurement of thermal expansion and


Stainless Steel Blender with spiral agitator; one of various types specially adapted to the viscosity of the mixture to be handled. Plate No. 1595.

STAINLESS STEEL PROCESSING EQUIPMENT

that CORROSION CAN'T CONQUER

When you specify stainless steel, you're really specifying *corrosion resistance*—something easier to ask for than to get. For in every stage of the fabrication of stainless steel—in bending, forming, welding—metallurgical changes may take place which reduce corrosion resistance.

The primary safeguard for your investment, so far as corrosion resistance is concerned, rests on two things: First, the experience of your fabricator with the behavior of the alloy during fabrication. Second, the operating experiences of your fabricator's customers who use stainless steel for applications similar to your own.

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Almost from the very first day that the processing industry turned to stainless steel for maximum corrosion resistance, our organization has specialized in fabricating this alloy. We work chiefly with stainless steel in gauges up to 3/8" thick. Our engineers command expert knowledge of *all* the techniques that preserve *all* the properties you expect to get when you specify stainless steel. Working extensively with specialized equipment, much of it is designed exclusively for us, these engineers assure maximum corrosion resistance in your processing equipment. Consult with us.

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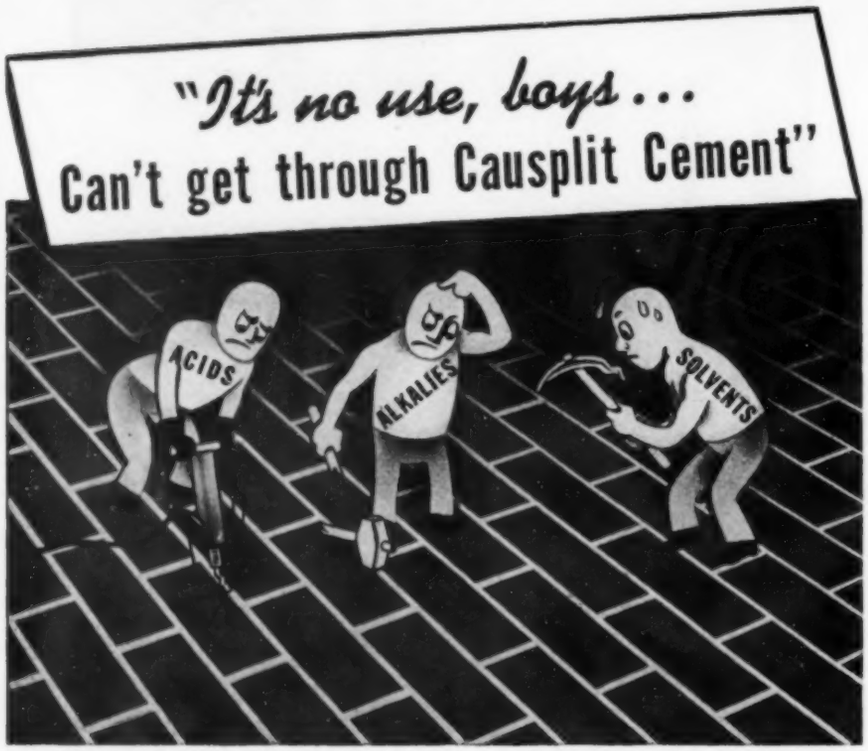

Its unique chemical resistance makes Causplit Cement a success where other cements fail. For Causplit readily handles a wide range of strong acids, alkalies and solvents at temperatures up to 350°F.

And Causplit is quick-setting, tough and durable, easy to apply, resistant to abrasion and to rapid changes in temperature. Proved admirable for corrosion-proof equipment lining in extensive industrial tests, Causplit Cement represents a considerable improvement over Penchlor Acid-Proof Cement and Asplit Cement, which have been successfully used in many industries for over 7 years.

CHEMICAL PLANTS profit by using Causplit because it resists hydrochloric, phosphoric and other strong acids, carbonates, sulfates and other salts, ammonia and various strong alkalies, phenol, toluol, alcohols, acetone and numerous other chemicals. Causplit Cement can be used in equipment handling alkalies and acids alternately—where other cements "wash out."

PAPER AND PULP MILLS find Causplit economical and durable for pulp digesters, bleaching system equipment, acid towers, recovery systems, etc. It withstands abrasion, repeated washings, sudden temperature changes, and chemicals used in the industry—including 50% caustic soda, soda ash, hypochlorites and chlorine, sulfurous acid, sodium sulfite, sodium sulfide, alum and others.

STEEL MILLS can use Causplit Cement for pickling, neutralizing and degreasing tanks and similar equipment because it is unaffected by sulfuric, hydrofluoric and hydrochloric acids, by strong alkalies, salts and solvents. Causplit maintains tight joints and preserves bricks, far outlasting other types of cement construction.

Penn Salt has been engaged for a great many years in the manufacture of acids and alkalies. We have naturally had considerable experience in the use of cements to resist corrosion, and are in a position to give technical advice. We will welcome inquiries on your problems.

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goes beyond dilatometric methods by making it possible to determine the anisotropy of expansion in metals which do not crystallize in the cubic system.

Study of alloys is enormously facilitated by x-ray diagrams, which reveal the separate phases and show the structure of alloys in equilibrium states. Results of heat treatments can be followed by x-ray examination. So can the effects of cold working and fatigue stresses. Internal stresses resulting from metallurgical processes can be detected. Through such observations improvements in metals and alloys can be based on systematic and exact knowledge of the structures involved.

Digest from "Crystal Analysis with X-Rays and Its Metallurgical Applications," by Paul Bastien. *Chimie et Industrie* 45, 531, 1941. (Published in France.)

WASHING COMPOUNDS AND ALUMINUM

TESTS with a number of proprietary washing compounds in 0.5 percent solution showed distinct corrosive attack on aluminum. Their principal active ingredients are sodium carbonate (soda ash), sodium metasilicate, trisodium phosphate (TSP), and sodium pyrophosphate. It was found that the metasilicate and the phosphates serve to mitigate the corrosiveness of soda ash, but the inhibiting action of TSP or sodium pyrophosphate is not sufficient for practical protection. Sodium metasilicate is a more active inhibitor. When soda ash is partly replaced by TSP or sodium pyrophosphate the soda ash content must be cut down thereby to 40–45 percent to make sodium metasilicate an adequately strong inhibitor in strengths below 20 percent. The conclusion is that washing powders for use on aluminum should contain about 25 percent sodium metasilicate.

Digest from "Effect of Dishwashing Compounds on Aluminum," by J. F. J. Thomas, *Canadian Journal of Research*, **19B**, 109, 1941. (Published in Canada.)

ELECTRIC DISCHARGE REACTIONS

IN GAS reactions under the influence of an electric arc, e. g. in the manufacture of hydrogen cyanide from hydrocarbon gases and nitrogen, the frequency at which the arc is operated makes no apparent difference in the mechanism of the gas reaction. A high frequency arc using only 10 watts gave an effect fully equal to that of a low frequency arc using 40 watts. The effect was measured spectroscopically. It was also observed that in passing from methane to its higher homologs the Swan bands in the spectrum increased in intensity, indicating greater degradation of carbon chains to form C_2 radicals. The result is that the higher hydrocarbon gases give a better yield of hydrogen cyanide than do the lower homologs. Thus, the maximum yield obtainable with methane and nitrogen is 65 g. of hydrogen

cyanide per kwh. of power consumed, whereas a mixture of butane, hexanes and octanes will yield as much as 120 g.

Digest from "Chemical Action of Electric Discharges. XXII. Note on Some Characteristics of High and Low Frequency Arc Spectra of Gas Mixtures Containing Hydrocarbons," by B. P. Susz, H. Hoefer and E. Briner, *Helvetica Chimica Acta* **24**, 501, 1941. (Published in Switzerland.)

DISTILLATION AND CONDENSATION IN SPRAY TOWERS

BY BLOWING a gas or vapor through a slit at a speed of 3 to 12 meters per second a layer of liquid 3 to 10 mm. deep above the slit can be blown into a fine spray rising well above the liquid and constantly renewed from below. The resistance is only about 30 mm. of water column. The resulting heat exchange between vapor and liquid reaches an efficiency never before attained. For example, in distilling alcohol from dilute aqueous solution to 95 percent strength the new method required only 20 bubble cap trays to give the same effect previously given by 40 trays. Performance of gas scrubbers is similarly improved. The injector effect of the blowers overcomes resistance to flow through orifices, so that the scrubber operates without resistance. The power consumption of the blowers is only about 0.56 hp. per metric ton per hr. One scrubber of this type will do the work of four ordinary scrubbers. Arrangement of scrubber chambers may be vertical or horizontal, according to whether small ground space or small height is desired.

Digest from "Spray Columns for Distilling and Condensing," by C. H. Borrmann, *Oel und Kohle* **1**, 26, 1941. (Published in Germany.)

BASIC CHARGES IN THE MARTIN FURNACE

WHEN steel is made in a Martin furnace from a basic charge of high phosphorus cast iron, scrap iron and a high grade hematite ore ¾ of the dephosphoration occurs during fusion. This is because the temperature during fusion is low, and oxidation is proceeding with formation of iron (and manganese) phosphates. Toward the end, when the melt is still pasty, silicon is removed along with more of the phosphorus. Manganese protects the iron from oxidation by oxidizing first. Dephosphoration is complete when the carbon content has not fallen below 0.59 percent. The first slag can be scraped off, taking phosphorus and silicon with it, and a new lime slag can be formed. The metal can then be stabilized with ferrosilicon and the final additions can be made for bringing it to the specified composition. A high grade hematite will supply about 65 percent of the oxygen required to oxidize carbon, silicon, phosphorus and manganese in the operation, leaving 35 percent to be supplied as atmospheric

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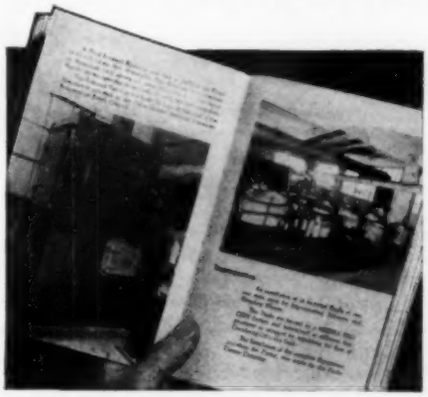

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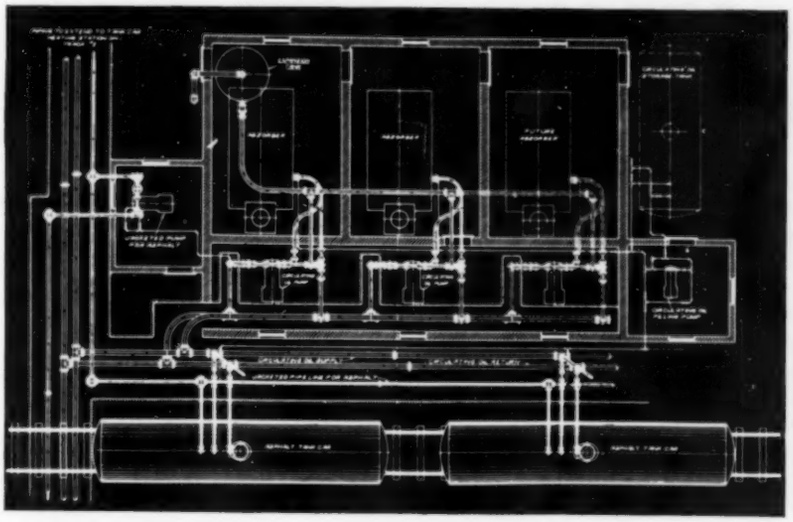

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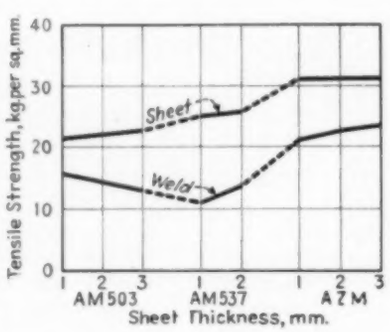
oxygen. The Martin furnace, with a basic charge, can be used in making a variety of steels, from very soft grades through mild to very hard steels.

Digest from "Basic Operation of the Martin Furnace," by A. Barberot, *Chimie et Industrie* 45, 3, 112, 1941. (Published in France.)

STRENGTH OF MAGNESIUM ALLOYS

INCREASING use of magesium alloys in machine parts, railway and automotive vehicles and aircraft has made strength a vital problem. Strength tests have therefore been made under permanent, temporary and operating stresses (tensile, flexing and torsional). Particular significance is attached to permanent stress, i. e. a stress to which the material is exposed constantly or intermittently throughout its service life. Data and curve charts are presented for round, flat, I-, L- and C-shaped test rods. Tube and sheet specimens were also tested, with some



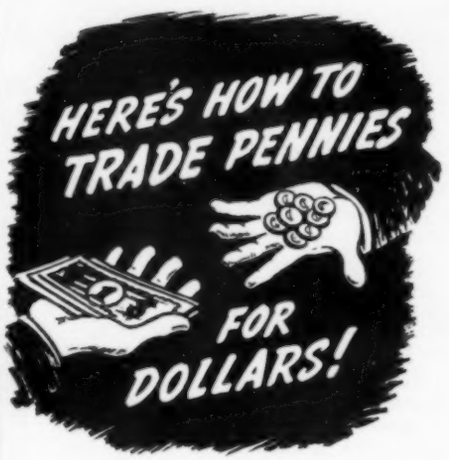
attention to effects of welds, mold skin, mill scale and pickling. The influence of welding on tensile strength is illustrated for Electron metal alloys AM503, AM537 and AZM by the curves in the drawing. Superiority of alloys with high tensile strength and high elongation at break is more conspicuous in tensile tests than in flexing tests.

Digest from "Permanent Strength Properties of Magnesium Alloys," by W. Buchman, *VDI-Zeitschrift* 85, 15, 1941. (Published in Germany.)

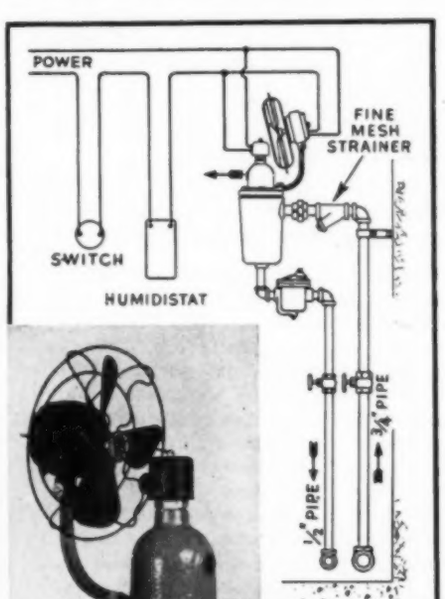
FACTICE IN RUBBER GOODS

BROWN and white factices, made by heating vegetable oils with sulphur or sulphur monochloride, have recently been supplemented by "Amberex" (vegetable oil lightly sulphurized in presence of an accelerator) and "Factex" (aqueous dispersion of partially vulcanized oil). A feature of all factices is that they resist heat until their decomposition point is reached, even remaining constant in plasticity as temperature rises. Hence factice in rubber tends to level the temperature effect in processing rubber. Factices can be made in any hardness from very soft to hard (5 to 50 on the Shore scale).

Brown and white factice improve handling of proofing compositions, facilitating removal of solvent by

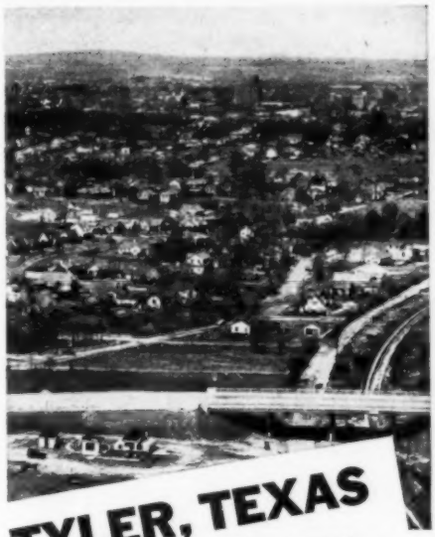


AT A DOLLAR A TON steam is one of the cheapest materials available to industry today. Yet in numerous instances it is being traded for material selling for anywhere up to $200.00 or more a ton. Surprisingly enough, there are still quite a few places where the opportunity is being overlooked and this winter will again see dry, heated indoor air rob many products of one of their most valuable components; MOISTURE CONTENT. Don't take that loss—install the low priced Armstrong Humidifiers. For complete details write ARMSTRONG MACHINE WORKS, 858 Maple St., Three Rivers, Michigan.



Armstrong Unit Humidifiers list at $100.00 each, complete with Friez humidistat, solenoid control valve, fan, strainer, and condensate drainage trap. Ask for new 8 page bulletin.

ARMSTRONG STEAM TYPE HUMIDIFIERS



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evaporation. Brown factice has many uses as a nonthermoplastic softener and extender in synthetic rubbers. Amberex gives transparent products when blended with about its own weight of synthetic rubber. Factex has a wide variety of uses as an ingredient in natural or artificial rubber latexes. Tysonite, a special ozoneproof brown factice, is particularly useful in insulation, for protecting insulated wire from the ozone generated in corona discharges.

Digest from "Factices as Compounding Materials," by O. B. Crowell, *Canadian Chemistry* 25, 170, 1941. (Published in Canada.)

A CORROSIVE IN FLUE GAS

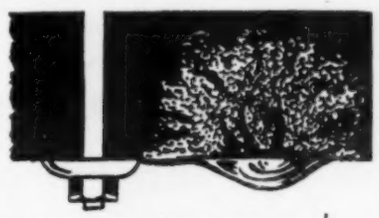
CORROSION of electrostatic precipitators installed in flues has been traced to phosphorus pentoxide in the flue gas. The precipitators were used by a power plant to remove water vapor from effluent gases from scrubbers in which sulphur dioxide and sulphur trioxide were recovered before venting the waste gases to the atmosphere. First the copper electrodes of the electrofilter were destroyed. This difficulty was overcome by using lead electrodes, but the steel supporting frame of the electrofilter was attacked next. Even the concrete of the stack was decomposed to some extent. Analysis of the corrosion products revealed a high content of phosphates, especially ferric phosphate on the steel work. Therefore to prevent this type of corrosion it is necessary to remove or inactivate phosphorus pentoxide, formed from phosphorus in the coal and passing into the flue gas.

Digest from "An Unexpected Corrosive in Boiler Gases," by H. J. Bush, *Chemistry and Industry* 60, 421, 1941. (Published in England.)

COLD ROLLING COPPER

MICROSCOPIC and x-ray studies of cold rolled annealed copper strips with four different crystal structures showed that the same twin fiber structures are ultimately developed from all four original structures if cold rolling is repeated often enough. The effect of approximately 50 percent reduction by rolling, followed by annealing, is to develop a random orientation of copper crystals. On the other hand, any preferred orientation present before rolling will persist to a perceptible extent until reduction by rolling reaches about 25 percent. When rolling reduction is carried beyond 50 percent the twin fiber structure sometimes proceeds to recrystallize independently, forming a double texture structure. In other cases it coalesces to a single texture structure. Increasing the final annealing temperature has little or no effect on structure, but increases grain size.

Digest from "Influence of Crystal Structure on Cold Rolling and Annealing Copper Strip," by Maurice Cook and T. L. Richards, *Journal of the Institute of Metals* 67, 203, 1941. (Published in England.)



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New Titles, Editions and Authors

HANDBOOKS AND YEARBOOKS

MINERALS YEARBOOK, REVIEW OF 1940. Prepared under the direction of *E. W. Pehrson*, Edited by *H. D. Keiser*, U. S. Bureau of Mines. For Sale by the Superintendent of Documents, Washington, D. C. 1459 pages. Price $2.

THE NEW edition of this authoritative source of information, made available more than three months in advance of the usual release date, contains additional features that will serve to increase its value. All the minerals classified as strategic or critical in the national defense program have received special attention. New information made available for the first time includes statistics on magnesium production and consumption by industries, reserves of domestic bauxite, stocks and requirements of nickel and reserves and probable future production of mercury.

Containing more information than ever before, the new edition has important new chapters, among which are those entitled "Effect of the International Situation on United States Trade in Minerals" and "Review of the Minerals Industry in 1940." The latter gives information on the organization of the various Government defense agencies dealing with the minerals industries. The total of 72 chapters presents by far the most complete and detailed study of these industries ever published.

A paper stock of slightly less weight than previously used but of equal durability has made possible a small reduction in thickness that should extend the life of the book. A number of additional charts have been included.

MINING ENGINEERS' HANDBOOK. Third Edition, in two volumes. Edited by *Robert Peele* and *John A. Church*. Published by John Wiley & Sons, Inc., New York, N. Y. 2442 pages. Price $15.

THE NEW edition of this excellent and well-known unit of the Wiley Engineering Handbook Series, written by a staff of 46 specialists, has been extensively revised in order to bring data and illustrations up-to-date. The comprehensive section on "Methods of Mining" has been changed to include important new material and two entirely new sections, "Petroleum Production" and "Geophysical Prospecting," have been added. Major changes were also made on the sections on "Mine Ventilation" and "Hoisting Plant, Shaft Pockets and Ore Bins" as well as those on "Compressed Air Practice" and "Underground Mechanical Loading, Conveying and Handling."

Volume I contains sections devoted to mineralogy and geology, explosives and excavations, tunneling, shaft sinking and boring, prospecting, development and exploitation of mineral deposits, underground transportation, drainage and ventilation, and others. Volume II includes material on power and compressed air, surveying and mapping, mine organization and economics, wages, hygiene, accidents and laws, operations such as underground loading, conveying and handling, crushing, sampling, assaying, testing, amalgamation and cyanidation, and preparation and storage of coals, as well as sections on mathematics and mechanics, hydraulics, thermodynamics, power, structural design, petroleum production methods, mechanical and electrical engineering, and engineers' tables.

HANDBOOK OF CHEMISTRY. Fourth edition. Compiled and edited by *N. A. Lange*. Published by Handbook Publishers, Inc., Sandusky, Ohio. 1935 pages. Price $6.

ALMOST indispensable to the chemist, nearly as valuable to the chemical engineer and highly useful to the physicist, metallurgist and engineer, the fourth edition of this standard handbook lives up fully to its reputation of being one of the distinct leaders in its field. Authenticity of data, completeness of coverage, easy legibility and typographical excellence, organization of subject matter, thoroughgoing index and rugged binding, all contribute to make it one of the most popular of all chemical reference books.

Among the tables offered for the first time in the present edition are those on synthetic rubbers, correction of boiling point for pressure, calculation of the boiling point of organic compounds, qualitative spectrographic analysis, conversion of specific gravity to density, azeotropic mixtures, tank and pipe capacities, and others. In addition, many tables have been extended or completely rewritten. Numerous changes in data have been made throughout the work in order to keep the information accurate and up-to-date.

COMMODITY YEAR BOOK, 1941. Prepared and published by Commodity Research Bureau, Inc., New York, N. Y. 636 pages. Price $7.50.

SEVENTY-FIVE basic commodities are discussed in this annual volume. And approximately one-third might be considered as being of interest to the chemical process industries (alcohol, aluminum, cement, etc.) Chief purpose of the study was to analyze war-time controls placed on commodities and the authors have traced the trend of events in World War I and the present war. Numerous charts and tables from various sources, in addition to the short discussions, make the book a good starting point for a commodity survey.

FUNDAMENTALS OF COMPRESSION

AIR AND GAS COMPRESSION. By *Thomas T. Gill*. Published by John Wiley & Sons, New York, N. Y. 181 pages. Price $3.

AS ONE of the important unit operations, compression of gases and air is a subject deserving of thorough and meticulous treatment by any author. Such treatment has been accorded the subject in this latest book. The advantage of the volume, however, is that it adequately covers the various phases of compression without excess verbiage. Nineteen chapters are included, each of which is only a few pages long. An introductory section of three chapters covers definitions and units, barometric pressure, and fundamental gas laws. Single, double and multi-stage compression, capacity, efficiency, the exponent of compression, supercompressibility and other details are all adequately handled in separate chapters. A chapter on compressors describes available machines. Gas lift, flow of gas in pipelines, gas measurement by orifice meter, and use of alignment charts are the concluding chapters.

The last chapter serves as introduction to an appendix of 27 alignment charts which will greatly facilitate calculations. Their use is illustrated by solution of typical problems. Following the charts are 33 pages of tables giving constants, conversions, and other data for ready reference.

As the author points out, recent researches in the properties of gases, especially in regard to compressibility, critical data and specific heats, warrant the publication of a new textbook on the theory of compression.

TARIFF COMMISSION REPORT

LATIN AMERICA AS A SOURCE OF STRATEGIC AND OTHER ESSENTIAL MATERIALS. Report No. 144, Second Series. U. S. Tariff Commission. For sale by Superintendent of Documents, Washington, D. C. 397 pages. Price 50 cents.

CHARACTERIZED by the usual all-round excellence of the Tariff Commission Reports, this study is particularly appropriate at the present time: first, as a source of reliable and condensed information on certain materials strategic or critical to the National Defense pro-

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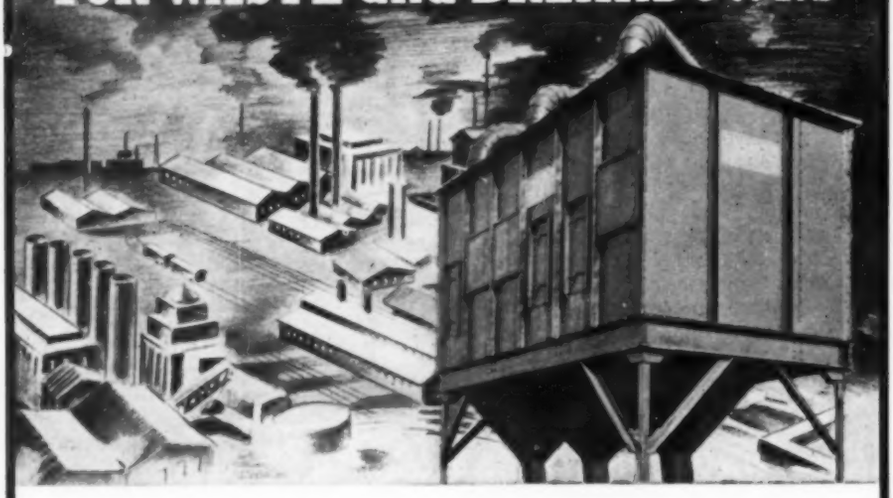

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gram and second, as a valuable handbook for persons interested in the promotion of trade between Latin America and this country. Some 20 mineral and 23 agricultural, pastoral and forest products are discussed. Comprehensive data on production, imports, exports, and prices are given. This book, along with other similar Tariff Commission reports, should be on the bookshelf of every person interested in the economic and statistical aspects of chemical commodities and raw materials.

ENGINEERING ENCYCLOPEDIA. Edited by *Franklin D. Jones*, Published by the Industrial Press, New York, N. Y. 1431 pages. Price $8.

MATERIALS, machinery and mechanical operations as well as hundreds of technical terms are covered in this two-volume latest addition to the engineer's reference shelf. The paragraphs devoted to each topic, from a few lines to several pages as the subject may deserve, give essential information of a practical nature. Chemical engineers will find that chemicals and chemical operations are described more fully and accurately in other standard references and handbooks. However, for quick surveys and general descriptions of the terms, operations and techniques of other branches of engineering this volume will be found helpful.

THE SPECTROCHEMICAL ANALYSIS OF METALS AND ALLOYS. By *F. Twyman*. Published by Chemical Publishing Co., Brooklyn, N. Y. 355 pages. Price $8.50.

YEARS of experience are behind the appearance of this book. Connected with a large British firm of spectrographic equipment makers, the author has been in a position to keep abreast of advances in tools and techniques. Aided by this knowledge and drawing freely from the published literature, Mr. Twyman has gotten together a reference book on a subject which is of increasing industrial importance. In two parts: Part I discusses history, theories, spectrographs, accessory apparatus and the microphotometer. In Part II are included methods of exciting spectra, identifying elements, techniques, types of problems to which the methods are applicable, analysis of nonmetallic substances. One long chapter in this section deals with the determination of the following metals and some of their alloys: Al, Cd, Cu, Au, Fe, Pb, Mg, Ni, Ra, Ag, Sn, Zn, and the platinum metals.

The book has apparently been reproduced by some photographic process which resulted in loss of detail from the illustrations and spectrograms shown. There is an extensive bibliography and author index. A subject index is also included.

In the preface it is pointed out that "spectrographic analysis" is an ambiguous title which could mean "analysis of the spectrum" or "analysis by means of the spectrum." The author further

says a new name or title is needed for the subject and that he "looks with confidence to my friends in the United States to help us out with their genius for coining labor-saving words." Any suggestions?

AN INTRODUCTION TO GENERAL CHEMISTRY. Second edition. By *William Foster* and *H. N. Alyea*. Published by D. Van Nostrand Co., New York, N. Y. 790 pages. Price $3.75.

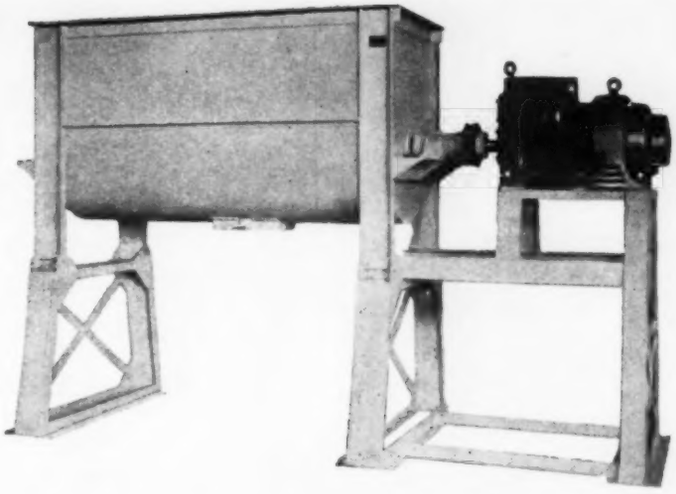
OF COLLEGE caliber, Prof. Foster's book has served well for a decade. Prof. Alyea's revision devotes essentially the same space to each topic but approaches are newer. Primarily they involve energy considerations and other modernizations of theory and practice. The book is divided into five parts: Introduction, physical, inorganic, organic and colloid chemistry.

AN INTRODUCTION TO ORGANIC CHEMISTRY. Fourth Edition. By *Roger J. Williams*. Published by D. Van Nostrand Co., New York, N. Y. 628 pages. Price $4.

THE FOURTH edition of this introduction to organic chemistry rightly deserves its popularity as a "beginner," for the author has adhered faithfully to his original objective of treating organic chemistry as a logical rather than as a memorizable subject. The present edition, while following closely the outline of the earlier editions, has been improved in organization and method of presentation. The subject matter has, in several cases, been reorganized into a more logical sequence, while certain mechanical features, such as side heads, structural formulas and general typography, have improved the appearance of the book. Some additional material, mostly dealing with very recent developments, has been introduced. However, such material considered as somewhat more advanced than the general text has been introduced in fine print.

Consistent with his policy of introducing the unknown in terms of the known, the author has included brief but interesting information on the industrial use and economic importance of the more widely known organic compounds. Thus the student learns to associate fundamental theory with commercial application. Recent developments, including nylon, are dealt with briefly. Tables included throughout the text give interesting comparative data on groups of similar compounds. However, in order to complete the tables, certain physical data not available in the earlier editions should now be included.

This book will undoubtedly continue to be a favorite as an introduction to college organic chemistry. This reputation it rightly deserves for, as Dr. Williams probably learned from Professor Julius Stieglitz, a student's appreciation for a branch of chemistry will seldom exceed that derived from the introductory impression.



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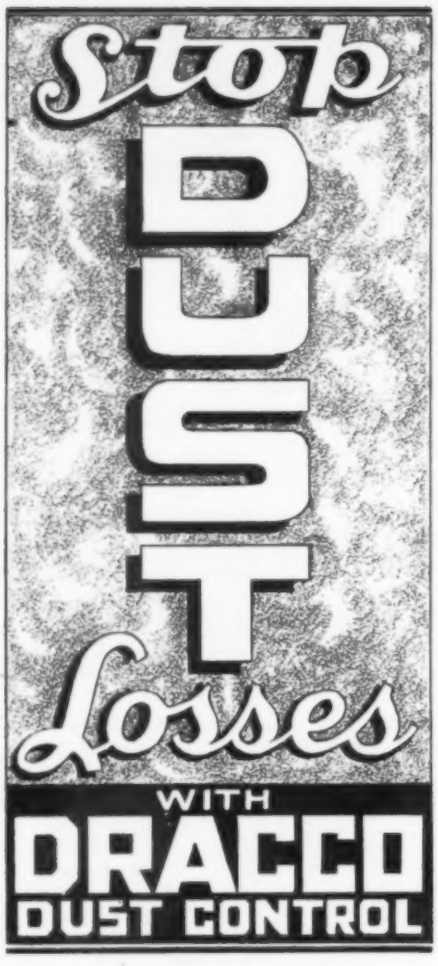

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Occupation Hazards and Diagnostic Signs. Bulletin No. 41 of Division of Labor Standards. By *L. I. Dublin* and *R. J. Vane*. Available from Superintendent of Documents, Washington, D. C. 70 pages. Price 10 cents. A revised edition. Gives alphabetical list of hazardous occupations and list of hazards, symptoms, occupations exposed, and methods of prevention. Under poisons, 128 materials are listed together with symptoms, conditions, or diseases to look for and occupations which offer such exposure.

How to Keep Wage and Hour Records. Published by the U. S. Department of Labor, Wage and Hour Division, Washington, D. C. 31 pages. Shows employers how to keep records for employees entitled to the minimum wage and to overtime after 40 hours a week, also deals with keeping of records under exemptions from the Act.

Aircraft Engines, Vol. II. By *A. W. Judge*. Published by D. Van Nostrand Co., New York, N. Y. 446 pages. Price $9. Largely descriptive in treatment as compared with Vol. I which stressed theory. (See Chem. & Met. Dec. 1940, p. 885.) Engines designed and in use prior to 1940 are included and, for obvious reasons, most data are concerned with those of British and American manufacture. Well illustrated with numerous halftones, drawings and charts.

Chemical Kinetics and Natural Products. Published by the University of Pennsylvania Press, Philadelphia, Pa. 41 pages. Price 50 cents. Contains three papers: "The Photochemistry, Fluorescence, and Spectroscopy of Certain Polyatomic Molecules" by *W. Albert Noyes, Jr.*; "The Kinetics of Contact Catalysts and the Industrial Background" by *Hugh S. Taylor*; "The Chemistry of the Ergot Alkaloids" by *Walter A. Jacobs*.

Test it yourself! By *L. F. Tuleen, W. L. Muehl* and *G. S. Porter*. Published by Scott, Foresman & Co., Chicago, Ill. 290 pages. Price 96 cents. Laboratory workbook of 70 experiments in elementary chemistry. Foods, drinks, cosmetics, lubricants, anti-freezes, and the like are tested. Page references for 14 elementary chemistry tests are given.

Papers in Chemistry and Chemical Engineering. Circular No. 169, Lehigh University, Bethlehem, Pa. Price 10 cents. Reprinting of 14 papers which were published during 1940-41 in various chemical journals by the faculty and students of Lehigh. Includes studies in unhairing, vacuum tube relays, a history of Bethlehem waterworks, and several organic preparation procedures.

Guide to Library Facilities for National Defense. Revised edition. Edited by *Carl L. Cannon*. Published by the American Library Association, Chicago, Ill. 448 pages. New edition of the book which was published in preliminary form earlier this year. (See *Chem. & Met.*, Feb. 1941, p. 182.) Revision has consisted of the addition of more than 200 pages of new material and includes many new headings. The directory of libraries has been shifted into the text. Under subject headings libraries are now listed by states rather than by regions of the country.

New Encyclopedia of Machine Shop Practice. Edited by *George W. Barnwell*. Published by Wm. H. Wise & Co., New York, N. Y. 561 pages. Price $1.98. Sixteen chapters, each written by an authority. Covers machine shop operations and equipment: bench work, the lathe, milling, jigs and fixtures, metals in engineering production, heat-treatment of metals, machine drawing and other aspects. Thumb-indexed for easy reference, an inexpensive and valuable contribution for today's busy machine shops.

Metal Processing. By *O. W. Boston*. Published by John Wiley & Sons, New York, N. Y. 630 pages. Price $5. A college textbook but adaptable for short and industrial courses, this volume can be recommended for use in the numerous shops and schools which are now training machinists for National Defense work. Durable binding, good paper, excellent illustrations and numerous tables of pertinent data add to the book's value. Twenty chapters describe machines, their uses and operation.

Books, Publications, and Patents of Battelle Memorial Institute. Compiled by *T. R. Reinberg*. Published by Battelle Memorial Institute, Columbus, Ohio. 47 pages. Gratis. A listing of more than 500 books, patents and journal contributions to the technological literature made by Battelle staff members during the 11-year history of the Institute.

Moisture Characteristics of Carbon Black. By *S. V. Stoddard* and *C. P. Baker*. Published by Northeastern University, Boston, Mass. 15 pages. Gratis. Results of an investigation to determine the amount of moisture present in carbon black throughout the common range of atmospheric humidities.

Impact Resistance and Tensile Properties of Metals at Subatmospheric Temperatures. Prepared by *H. W. Gillett*. Published by the American Society for Testing Materials, Philadelphia, Pa. 122 pages. Price $2.50. A report resulting from two years' study by a joint A.S.M.E.-A.S.T.M. research committee. Over 50 percent of the material presented is in the form of tables.

GOVERNMENT PUBLICATIONS

Documents are available at prices indicated from Superintendent of Documents, Government Printing Office, Washington, D. C. Send cash or money order; stamps and personal checks not accepted. When no price is indicated, pamphlet is free and should be ordered from Bureau responsible for its issue.

United States Imports from Japan and Their Relation to the Defense Program and to the Economy of the Country. Tariff Commission unnumbered document prepared by Ben Dorfman, Samuel Lipkowitz, and others, giving principal economic data pertinent to the problems which would be created if a complete stoppage of imports from Japan should occur.

Regulation of Imports by Executive Action in Countries with Independent Tariff Jurisdiction. This Tariff Commission report records developments, from 1919 through 1940, in the delegation of power to regulate import trade by tariff changes, from the legislative to the executive branch of government, in countries which have now or have had until recently independent control of their import tariffs. The report is essentially a revised edition of the Commission's earlier report on "Regulation of Tariffs in Foreign Countries by Administrative Action." 15 cents.

Possibility of Producing Rubber in the United States. A short report issued by the Tariff Commission, discussing various methods of conserving rubber supplies and the feasibility of producing natural and synthetic rubber in the U. S. Available from the Tariff Commission office in Washington, D. C., or the Commission office in the Custom House, New York City.

Emergency Medical Service for Civilian Defense. This preliminary plan of proposed organization is first in a series of recommendations to state and local Directors of Civilian Defense concerning the augmentation of medical facilities in their areas. Office of Civilian Defense, Medical Division Bulletin No. 1, available without charge at headquarters office and from local Directors of Civilian Defense.

Insignias of Fifteen Defense Services. Illustrated pamphlet showing insignias and giving a description of the duties of each defense group. Office of Civilian Defense.

Summary of Major Legislation and of Federal Court Decisions on its Constitutionality, 73d-76th Congress, prepared by W. H. McClenon, of Legislative Reference Service. Senate Document No.

49, 77th Congress, 1st Session, 15 cents.

How to Sell to the Government For Civilian Needs. Department of Commerce, Industrial Series No. 2.

Electric Power Statistics. A statistical reporting service covering data on production of electricity, consumption of fuel, new construction, and other engineering facts. The annual subscription includes a binder and all supplemental reports for one year. Obtainable only at Federal Power Commission; $2.00.

Foreign Commerce and Navigation of the U. S. This volume of this series gives data for the year 1939. Compiled by Division of Foreign Trade Statistics, Bureau of Foreign and Domestic Commerce; $2.25 (buckram binding).

Typical Analyses Bituminous Coals. Contains descriptive tables of rail- and river-shipping mines, maps showing their locations, and analytical tables of seams by states and counties in Districts 7 and 8. Prepared by Consumers' Counsel Division, Deparment of the Interior, in cooperation with the U. S. Bureau of Mines; Data Book, Vol. I; 55 cents.

Employment and Earnings in the Engineering Profession 1929 to 1934. Department of Labor, Bureau of Labor Statistics Bulletin No. 682; 25 cents.

Directory of Organization and Field Activities of the Department of Agriculture, 1941, compiled by Edmund Stephens. Department of Agriculture Miscellaneous Publication No. 431; 25 cents.

Workers in Subjects Pertaining to Agriculture in Land-Grant Colleges and Experiment Stations, 1940-41, by Betty T. Richardson. A personnel directory. Department of Agriculture, Office of Experiment Stations, Miscellaneous Publication No. 420; 20 cents.

Quality of Irrigation Waters of the Hollister Area of California, with special reference to Boron content and its effect on apricots and prunes, by Frank M. Eaton, Roy D. McCallum and Miles S. Mayhugh. Department of Agriculture, Technical Bulletin No. 746, issued March, 1941; 30 cents.

Field Infestation by Insects that Injure Rice in Storage, by W. A. Douglas. Department of Agriculture, Circular No. 602, issued May, 1941; 5 cents.

Changing Technology and Employment in Agriculture, by John A. Hopkins, issued May, 1941. Summary of 12 monographs published by the WPA National Research Project on Reemployment Opportunities and Recent Changes in Industrial Techniques. Department of Agriculture, Bureau of Agricultural Economics; 25 cents.

Petroleum and Natural-Gas Fields in Wyoming, by Ralph D. Espach and H. Dale Nichols. Bureau of Mines Bulletin 418; $2.25, with maps.

Softening Water with Non-metallic Minerals, by S. J. Broderick. Bureau of Mines Report of Investigations, 3578; mimeographed.

Constancy of B.T.U. Value of "Pure" Coal, by J. F. Barkley and L. R. Burdick. Bureau of Mines Report of Investigations 3572; mimeographed.

Ore-Testing Studies (Primarily Precious Metals), by Edmund S. Leaver, Jesse A. Woolf and A. P. Towne. Bureau of Mines Report of Investigations 3569; mimeographed.

Carbonaceous Cation and Anion Exchangers in Water Treatment, by S. J. Broderick. Bureau of Mines Report of Investigations 3571; mimeographed.

Cooperative Fuel Research Motor-Gasoline Survey, Winter 1940-41, by E. C. Lane. Bureau of Mines Report of Investigations 3576; mimeographed.

Developments in Petroleum Refining Technology in the U. S., 1914-19, by A. J. Kraemer. Bureau of Mines Information Circular 7172; mimeographed.

Lime-Fuel Ratios of Commercial Lime Plants in 1939, by Forrest T. Moyer. Bureau of Mines, Information Circular 7174; mimeographed.

Water Problem in the Pennsylvania Anthracite Mining Region, by S. H. Ash. Bureau of Mines Information Circular 7175; mimeographed.

Barometers and the Measurement of Atmospheric Pressure, by C. F. Marvin. Department of Commerce, Weather Bureau Circular F, Instrument Division, Seventh Edition, Revised 1941; 15 cents.

Industrial Corporation Reports for 1939. A summary by industry groups, including 76 industries covered by the

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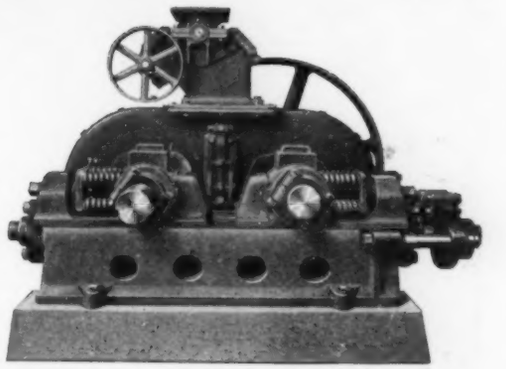

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Federal Trade Commission's project for the collection of annual reports from the more important corporations operating in many of the principal industries of the U. S.; issued June 30, 1941; Federal Trade Commission unnumbered pamphlet.

Administrative Procedure. Hearings, 77th Congress, 1st session, before the Senate Judiciary Committee on Senate Bills 674, 675, and 918, relating to administrative procedure of Federal agencies. Part 1, April 2-29, 1941, 50 cents; Part 2, April 30-May 22, 1941, 45 cents.

Requisition of Property. Hearings, 77th Congress, 1st session, before Senate Military Affairs Committee, on S. 1579, to authorize the President to requisition certain property for the use of or disposition by the U. S.; Part 1, June 18, 19, 23, 30 and July 1, 1941, 20 cents; Part 2, July 1, 16, 17, 1941, 10 cents.

Quicksilver Prospects. Some quicksilver prospects in adjacent parts of Nevada, California, and Oregon, 1941, p. 23-37, maps. Geological Survey Bulletin 931-B; 25 cents.

Electric Batteries and Standard Cells. Mimeographed summary of publications by the staff of the National Bureau of Standards and references to other sources of information; Letter Circular 656 (superseding LC-610).

Moisture Regains of Cotton Yarns, (Second Edition) Commercial Standard CS11-41 (Supersedes CS11-29); National Bureau of Standards, printed pamphlet; 5 cents.

Theoretical Calculations for Explosives. Bureau of Mines Technical Paper 632. This paper titled "Explosion Temperatures and Gaseous Products and the Effects of Changes in Carbonaceous Material," is the first of a series designed to show that theories now existing will, if modified, yield valuable information on detonating explosives; 5 cents.

Federal Specifications. New or revised specifications include: Sweeping Compound, P-C-591a, 5 cents; Portland cement, SS-C-191b, 5 cents; Portland cement, moderate-heat-of-hardening, SS C-206a, 5 cents; Portland cement, sulphate-resisting, SS-C-211a, 5 cents; hydraulic cement, general specifications, including method for sampling, inspection and testing, SS-C-158a, 10 cents. These specifications cover purchasing by most government departments, bureaus, etc.

Wood-Preservative Specifications. A new set of specifications for various types of wood preservatives has been issued by the Procurement Division of the Treasury Department, all effective December 1, for government purchases. Each of the following items is available by purchase as a separate pamphlet at 5 cents each: TT-W-531, anthracene-oil (for) brush, spray, or open-tank treatment (superseding part of TT-W-561a); TT-W-546, celcure (acid-cupricchromate); TT-W-551, chromated-zinc-chloride; (TT-W-556a, coal tar-creosote; TT-W-560, coal-tar-creosote (crystal-free), (for) brush, spray, or open tank treatment (superseding part of TT-W-561a); TT-W-568, creosote-petroleum-solution; TT W-571b, recommended treating practice; TT-W-573, Wolman-salt (tanalith); TT-W-576a, zinc-chloride; TT-W-581, zinc-meta-arsenite (ZMA).

Emergency Specifications. Emergency alternate Federal specifications have been approved for the immediate use of all departments and establishments of the government, in order to conserve certain strategic materials. These specifications supersede those normally used in government buying. They are in mimeographed form and may be obtained from the Federal Catalog Division, Treasury Department, Washington, D. C. Typical of such items are specifications for battleship linoleum; molded sheet and strip rubber gaskets; cloth-insertion rubber packing; wire insertion rubber packing; aluminum-pigment-paste for paint; aluminum-powder for paints (aluminum-bronze-powder).

Census of Manufactures, 1939. Printed pamphlets summarizing final data for various industries are now being published in advance of bound volume for the census which covered manufacturing operations in 1939. Already issued are approximately one-half of these pamphlets. Others will follow at short intervals. Individual pamphlets are 5 cents or 10 cents each, according to size.

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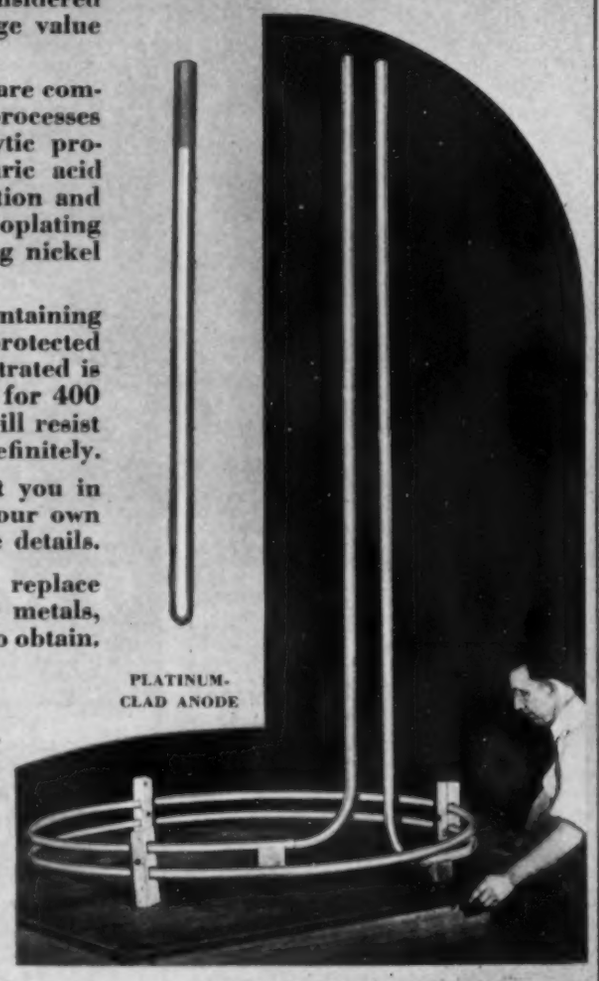

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Improvements in metallurgical processes, increasing useful life.

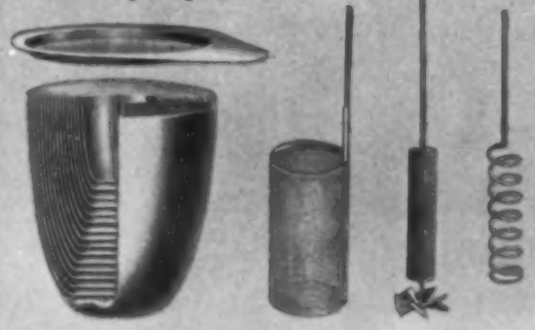
Development of the platinum-rhodium alloy, so widely used.

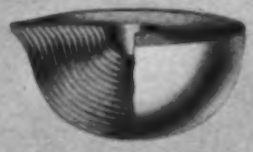
Design changes like the reinforced rim for crucibles and dishes.

Development of the low form crucible.

Improvements in the design of platinum electrodes.

We are constantly seeking new ways to make platinum ware better. Our unusual facilities enable us to make prompt deliveries.





BAKER & CO., INC.

REFINERS, WORKERS, SMELTERS OF PLATINUM, GOLD, SILVER

113 Astor Street, Newark, N. J.

NEW YORK SAN FRANCISCO CHICAGO

MANUFACTURERS' LATEST PUBLICATIONS

Publications listed here are available from the manufacturers themselves, without cost unless a price is specifically mentioned. To limit the circulation of their literature to responsible engineers, production men and industrial executives, manufacturers usually specify that requests be made on business letterhead.

Air Filters. American Air Filter Co., Inc., Louisville, Ky.—4-page reprint on electrostatic air filters which describes use of these in textile plants, food industries, welding, etc. Includes photographs of actual installation and cross-sectional drawings.

Alloys. Ampco Metals, Inc., 1745 S. 38th St., Milwaukee, Wis.—16-page catalog describing this concern's "Ampcoloy" series of bronzes, illustrated with photomicrographs, descriptions of the alloys, and a comprehensive table of physical properties and range of chemical composition.

Alloys. The International Nickel Co., Inc., 67 Wall St., New York—12-page folder giving individual characteristics, mechanical properties and application information on the various nickel alloys issued by this concern. Includes tables of physical constants and available forms.

Bearings. R. W. Rhoades Metaline Co., Inc., 50–17 5th St., Long Island City, N. Y.—Catalog 5—16 pages on this concern's oilless bronze bearings. Includes three sections; the first describes lubricating properties of "Metaline" oilless lubricant, the second the various types and applications for oilless bearings, and the third presents detailed data for use in preparing specifications. Profusely illustrated.

Belting. Allis-Chalmers Mfg. Co., Milwaukee, Wis.—Bulletin B6190—8-page booklet on "Super-7" V-belt, including general descriptive material, selection table and complete price list. Also Bulletin B6051B, 12-pages describing the complete line of this concern's drives, with information on various types of sheaves and speed changers. Includes photographs, selection tables, list prices and stock sizes, cross-sectional drawings, and other engineering data.

Blowers. Ilg Electric Ventilating Co., Chicago, Ill.—64-page engineering data book on this concern's blowers of various types. Includes illustrations, data on uses of each type, characteristics curves, dimension and performance data, fan performance laws, air friction and duct graphs.

Chemicals. Koppers Co., Tar & Chemical Division, Koppers Bldg., Pittsburgh, Pa.—28-page folder entitled "Chemicals from Coal" which lists, gives physical properties, information on industrial uses, and grades of 25 coal-tar chemicals produced by this concern.

Cleaning. Homestead Valve Mfg. Co., Coraopolis, Pa.—Publication 17A10—8-page folder on this concern's high-pressure steam cleaner for machinery, buildings, floors and walls, motors, etc. Includes information principles and operation, specifications and selection data.

Control Instruments. The Brown Instrument Co., Philadelphia, Pa.—Bulletin 742—8-page folder on this concern's furnace pressure controller, including photographs, description of the control system, schematic hook-up diagrams, and mounting dimensions. Also Catalog 2204, dealing with mechanical flow and liquid level meters. Contains 16 pages of illustrations, descriptive material, hook-up diagrams, mounting dimensions, and engineering data on various recorders.

Control Instruments. Fischer & Porter Co., Hatboro, Pa.—Bulletin 9051—8-page folder on this concern's new "Rotaweirs" for use in continuous distillation units for automatically splitting flow from condensers into any desired proportion of reflux and product stream. Includes description of operating principles, photographic illustrations of units, cross-sectional drawings, and other engineering data; also Bulletin 8001, 12-page folder entitled "Theory of the Rotameter" which contains useful engineering information in chart, table, and drawing form. Includes information on capacities and correction factors.

Control Instruments. The Hays Corp., Michigan City, Ind.—A series of 7 engineering monographs on boiler room instrumentation and automatic combustion control. Contains engineering information in the form of text material and diagrammatic illustrations. Also Folder 41452, 12-page booklet entitled "The ABC of CO_2," containing drawings, charts, and other material on CO_2, its measurement and control. Also No. 40448, 20 pages devoted to automatic combustion control and its relation to lower steam costs, with photographs, engineering drawings, charts and diagrams. Also publication 41472, 20 pages on draft, what it is, where found, how measured, and why it is important. Includes illustrations of various control instruments, diagrammatic illustrations and engineering information.

Control Instruments. National Technical Laboratories, South Pasadena, Cal.—12-page folder entitled "What Every Executive Should Know About pH". Discusses in non-technical language principles and applications of pH control, together with a brief description of this concern's equipment.

Control Instruments. Photoswitch, Inc., 21 Chestnut St., Cambridge, Mass.—Sheet 1100—4-page folder describing and illustrating this concern's electronic level controls for use with all liquids and powders. Includes data on operations, typical applications, types of units available, auxiliary apparatus, specifications, and prices.

Control Instruments. United Electric Controls Co., 69 A St., Boston, Mass.—11-page folder on this concern's electric temperature and pressure controls, with particular reference to electric thermostats for industrial uses. Contains photographs of the various units, diagrammatic sketches, description of various features, data on operation and uses, charts, specifications and prices.

Control Instruments. Wheelco Instruments Co., Harrison & Peoria Sts., Chicago, Ill.—No. 1 of Vol. 1 of this concern's house organ entitled "Wheelco Comments" which will be devoted to instrumentation in various industries.

Conveyor Belts. The Cambridge Wire Cloth Co., Cambridge, Md.—140-page catalog on this concern's woven wire conveyor belts for conveying and treatment of industrial products. Special sections, illustrated, appear on installations in the food, processing, glass and ceramic, and other industries. Engineering data includes chapters on metals and alloys, conveyor design, installation and operation.

Electrical Equipment. The Electric Storage Battery Co., 19th St. and Allegheny Ave., Philadelphia, Pa.—Form 4316—4-page folder announcing this concern's emergency lighting battery system equipped with either chloride or flat plate batteries, with illustrations, brief descriptive material, diagrammatic sketches, specifications, and other engineering data.

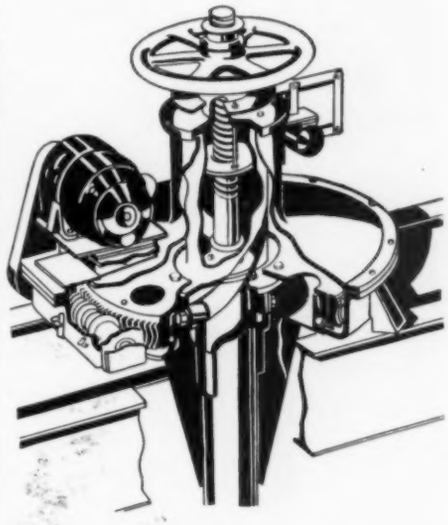
Electrical Equipment. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.—Bulletin B-2285—8 pages describing this concern's "Flexarc" welders for jobs ranging from light gage sheet to heavy duty industrial fabrication. Includes information on selection of equipment and ratings of units. Also Section 43-330, 12-page bulletin on miniature voltmeters and ammeters in the 2-in. classification for general use. Typical instruments are illustrated and construction details shown, including a complete tabulation lists ratings, scale divisions, style numbers and list prices

"AUTO-RAISE"

THICKENER

AND

HOW IT WORKS



The Hardinge "Auto-Raise Driving mechanism prevents overloads from damaging the driving or scraping mechanism.

When an overload occurs, the entire scraping mechanism raises above the obstruction.

The overload device is located in the drive mechanism housing above the liquid level and consists of rollers attached to the scraper shaft riding up an inclined track when the scrapers encounter undue resistance.

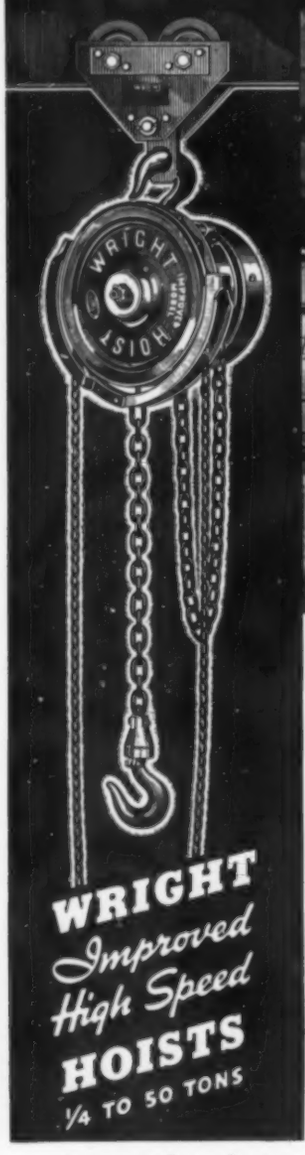
Write for Bulletin 31-C.

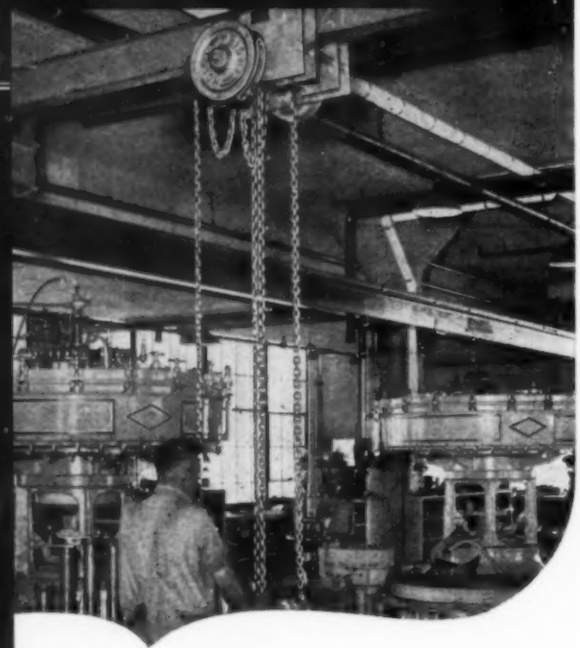
HARDINGE

COMPANY, INCORPORATED

YORK, PA., Main Office & Works
NEW YORK, 122 East 42nd Street
CHICAGO, 205 W. Wacker Drive
SAN FRANCISCO, 501 Howard St.
TORONTO, 200 Bay Street

THE WRIGHT WAY TO SPEED PRODUCTION





WRIGHT *Improved High Speed* **HOISTS**
¼ TO 50 TONS

● *FASTER, ever faster* production is demanded of American industry. One tool that will help speed up your production is the Wright Improved High Speed Hoist.

Wright Hoists are engineered for *fast*, high speed work. Their action is smooth and positive—because of their correct load wheel and driving spindle bearings. They are also *safe* and *economical.*

Ruggedly constructed on precision design, Wright Hoists give you long-time trouble-free service.

As with all ACCO products, safety is an in-built feature. The load chain has a safety factor of 7 to 1. It is made of a special process steel which permits the chain to elongate (under overload) 3″ to the foot before breaking. This same visual factor of safety is inherent in the bottom hook which will slowly open to indicate overload beyond the elastic limit of the chain.

WRIGHT TROLLEYS are made to give the same *fast, economical, safe* service as WRIGHT HOISTS.

WRIGHT MANUFACTURING DIVISION
YORK, PENNSYLVANIA

AMERICAN CHAIN & CABLE COMPANY, Inc.
In Business for Your Safety

for the miniature instruments. Also Leaflet 85-910 which describes a pocket-sized vibrometer for use in detecting and measuring mechanical vibrations in motors, generators, and other rotating machinery. Includes construction details and specifications. Also Booklet B-2304, 10 pages describing air-cooled transformers. Designed to answer typical questions on such transformers, for factories, mines and central stations. Contains information on advantages, safety features, design, size, weight, maintenance and applications.

Electrical Machinery. Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill.—Bulletin E-100C—48-page booklet entitled "Catechism on Electrical Machinery" designed to give a working knowledge of electrical machinery to the layman. Booklet describes and illustrates electricity and magnetism as utilized in electric generators and motors, electrical measurements, principles of direct current generators and motors, alternating current motors, and similar electrical machinery. Useful tables of practical application are included.

Electric Motors. Allis-Chalmers Mfg. Co., Milwaukee, Wis.—Bulletin B-6052—8-page folder describing the line of this company's motors of both inclosed and splashproof types. Includes descriptions, summary of types, outstanding features, and data on sizes, prices and dimensions.

Engineering Data. Ampco Metals, Inc., 1745 S. 38th St., Milwaukee, Wis.—File 41—56-page booklet entitled "Engineering Data Sheets" collected from 1934 to date, with extensive data on various bronze alloys for various uses such as for pump service, dies, aircraft parts, machine tools, lathes, etc. Information is in the form of general descriptive material, photographs, cross-sectional drawings, tables, and charts.

Equipment. Allis-Chalmers Mfg. Co., Milwaukee, Wis.—Form B-6178—32-page, large-sized bulletin entitled "Why it Pays to Buy from a Manufacturer who Builds a Complete Line." Includes a table of 115 materials associated with chemical processing industry and shows where each type of equipment fits into the flowsheet. Profusely illustrated.

Equipment. Blaw-Knox Co., Pittsburgh, Pa.—Bulletin 1830—16-page bulletin on this concern's equipment and plants for process industries, with descriptions and illustrations of recently developed items, such as handling and unloading plants for liquefied gases and high pressure-high temperature piping.

Equipment. Carrier Corp., Syracuse, N. Y.—Form 46-15—6-page folder on this concern's non-freeze unit heaters for various industrial heating installations. Contains extensive engineering data on specifications and operating conditions of the various units, also chart on B.t.u. constants and similar information.

Flooring. Open Steel Flooring Institute, American Bank Bldg., Pittsburgh, Pa.—12-page folder entitled "New Ideas in Functional Floor Design" designed to aid engineers on uses and properties of open steel gratings for floors, walkways, etc. Contains numerous photographs and brief descriptive material.

Glass Blocks. Owens-Illinois Glass Co., Toledo, Ohio—Bulletin IB-37, 38 and 39—4-page folders each discussing the application of "Insulux" glass blocks to light, maintenance and heating problems. Includes general discussion of uses and advantages, photographs of typical units, engineering data in drawing and chart form.

Instruments Kieley & Mueller, Inc., 40 W. 13th St., New York City—Catalog 66—150-page 1941 catalog, giving information on liquid level controls, strainers, pressure regulating valves, back pressure valves, power plant equipment, steam traps, float valves, and pump governors. Illustrated profusely with photographs and cross-sectional drawings, and includes engineering data on dimensions, construction materials, working pressures, principal construction features, and complete specifications and price lists.

Ion Exchange Resins. The Resinous Products & Chemical Co., Philadelphia,

Pa.—24-page compilation of loose-leaf sheets on this concern's "Amberlites", synthetic ion exchange resins for use in water purification, removal of certain cations from chemical and other process industry liquors, recovery of valuable elements from solutions, and purification of organic bases. Contains descriptive material on the mechanics of ion-exchange, development of ion-exchange synthetic resins, properties of such resins, and detailed information on types of resins, including capacity vs. particle size, flow rates, regeneration, conversion factors, etc. Also a section on methods of examination of exchange capacity of zeolites and resins.

Joints. Yarnall-Waring Co., Chestnut Hill, Philadelphia, Pa.—Bulletin EJ1908—20-page folder on this concern's expansion joints, with photographs of units, cross-sectional drawings, prices, shipping weights, and extension dimension tables.

Lathes. South Bend Lathe Works, 634 Niles Ave., South Bend, Ind.—Bulletin 52—8-page folder on this concern's precision lathes, including illustrations, basic dimension capacities and descriptions of attachments for tool room.

Magnesium. The Dow Chemical Co., Midland, Mich.—24-page catalog on magnesium as a structural metal. Includes information on uses for "Dowmetal", relative weights of structural metals, characteristics of magnesium alloys, properties of sand castings, mold castings, die castings, extruded alloy, forgings, and sheet, plate and strip. Profusely illustrated.

Materials Handling. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.—Booklet B-2264.—20 pages describing materials handling equipment for use in central stations, construction projects and industrial plants, electric motors and controls for cranes, hoists, etc. Includes a two-page application chart to facilitate selection of motors and control for typical materials handling operations.

Metal Hose. Seamlex Co., Inc., 5–19 48th Ave., Long Island City, N. Y.—Bulletins 300 and 410—Two sheets which illustrate and discuss this concern's flexible seamless all-metal hose with triple-sealed couplings. Includes data on standard sizes, safe working pressures.

Metal Tubes. The Babcock & Wilcox Tube Co., 85 Liberty St., New York—Bulletin TB319—24-page condensed catalog on seamless steel boiler tubes, alloy tubes and pipe for refinery and process industries, stainless steel tubes and pipe, and seamless steel mechanical tubing. Includes photographs and schematic line diagrams, process industry applications and similar information.

Metal Working. Standard Oil Co., Sales Technical Service Dept., Chicago, Ill.—Bulletin MW51—56-page bulletin entitled "Metal Working Operations" which includes engineering data on metal cutting, grinding, and forming, cutting fluids, soluble oils and paste compounds, grinding, honing, and lapping fluids, forming fluids, reclaiming and purifying metal working fluids, and other similar information. Well illustrated by photographs and drawings.

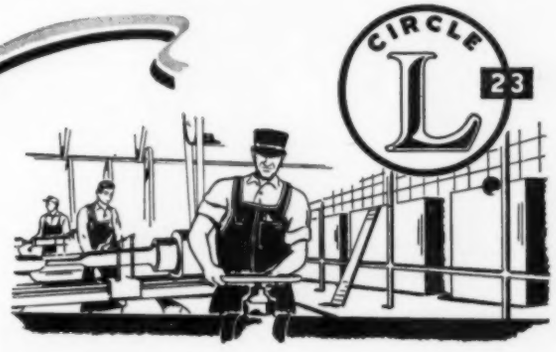
Mixers. National Engineering Co., 549 W. Washington Blvd., Chicago, Ill.—36-page catalog on this concern's intensive mixers, with illustrations of installations, operating principles, and diagrammatic sketches showing design. Text includes discussion of the mulling principle of mixing, advantages of control mixing, applications of intensive mixers in process industries, such as plastics, powder metallurgy, ceramic plants, etc. Also engineering data on each of the types of mixers put out by this concern, conversion tables, and general specification tables.

Powder Metallurgy. Moraine Products Div., General Motors Corp., Dayton, Ohio—Form 102—6-page folder on this concern's "Durex" iron made from powder. Use of iron powders and of powder metallurgy as an answer to the production of gears, bearings, and miscellaneous metal parts are discussed.

Pulverizers. Whiting Corp., Harvey, Ill.—Bulletins FY102—8-page folder illustrating and describing briefly this concern's pulverizing equipment, featuring the impact type. Includes data on

SYMBOLS of DEFENSE

THE 35TH DIVISION was one of the few American outfits in World War I which had no nickname. But the name for valor which these National Guardsmen of Missouri and Kansas earned in battle will long be remembered. In the critical fighting at Vauqois they served with special distinction. During 110 days of front line service, the Division suffered casualties of 7,926. Today, the National Guardsmen of Missouri and Kansas are preparing to defend American rights and American liberties against any encroachment by foreign aggressors.



THE ENCROACHMENT of corrosion is an attack aimed at the heart of industry. Against this attack, Circle (L) is the symbol of a sure defense. Among the corrosion resistant alloys developed by the Lebanon Steel Foundry, Circle (L) 23 is widely accepted because of its generally good corrosion resistant qualities combined with satisfactory physical characteristics. At Lebanon, this alloy is induction furnace melted. Consult a Lebanon metallurgist.

LEBANON STEEL FOUNDRY • LEBANON, PA.

ORIGINAL AMERICAN LICENSEE GEORGE FISCHER (SWISS CHAMOTTE) METHOD

LEBANON *Stainless and Special Alloy* STEEL CASTINGS

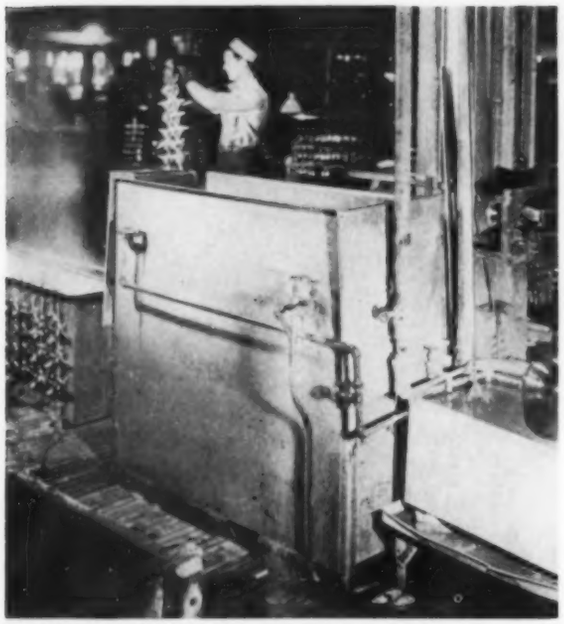
Corrosion-Resisting Equipment

THAT CONSERVES 80% OF VITALLY NEEDED NICKEL

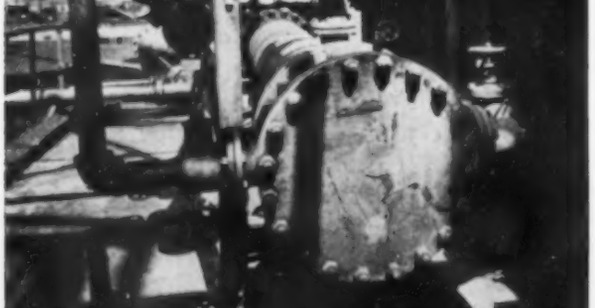
All this equipment is fabricated of 20% Lukens Nickel-Clad Steel. To make it of pure nickel would have required five times as much of this vitally needed metal.

Every pound of nickel goes five times as far in the form of 20% Lukens Nickel-Clad Steel plate. In the more generally used 10% Nickel-Clad Steel plate, every pound of nickel makes possible ten times as much corrosion-resisting equipment.

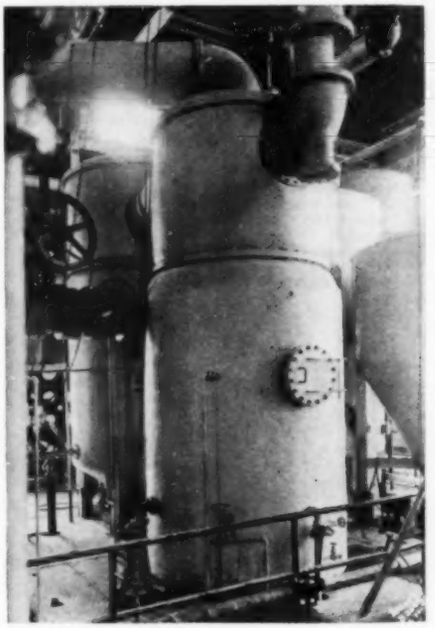
For data on Lukens Nickel-Clad, Inconel-Clad and Monel-Clad Steels, write Lukens Steel Company, 147 Lukens Building, Coatesville, Pa.



DEGREASING TANK: Highly resistant to corrosion from the small amounts of hydrochloric acid formed by hydrolysis, Lukens Nickel-Clad Steel is ideal for all types of equipment handling chlorinated solvents. This tank, employed in a metal degreasing operation, using trichlorethylene is 6′ 0″ x 2′ 3″ and 4′ 0″. Fabricated from $\frac{5}{16}$″ thick 20% Lukens Nickel-Clad Steel.



CAUSTIC SODA VESSELS: Because of its successful resistance to even the more concentrated caustic soda solutions, Lukens Nickel-Clad Steel is widely used in caustic soda evaporators, filters, settling tanks, storage tanks and crystallizers. These two caustic soda vessels, 7′ 0″ in diameter were fabricated from $\frac{3}{8}$″ thick 20% Lukens Nickel-Clad Steel by Service Electric Welding Company, Tacoma, Washington.



NAPTHA COOLER: The naphtha overhead from crude oil handled in this cooler contains sulfides and chlorides, with traces of phenol. The shell of this unit, approximately 2′ 0″ inside diameter and 11′ 8½″ long, was fabricated from ¼″ thick 20% Lukens Nickel-Clad Steel.

ALL-WELDED TANK CARS: A tank car for transporting caustic soda was the first commercial application of Lukens Nickel-Clad Steel, eleven years ago. Today Nickel-Clad tank cars are employed for transporting caustic soda, phenol, potassium hydroxide and other materials. Illustrated is one of five all-welded 10,000 gallon tank cars made of Lukens Nickel-Clad Steel by American Car and Foundry Company, Milton, Penna.

LUKENS STEEL COMPANY • *World's Largest Plate Mill* • **147 LUKENS BUILDING** • **COATESVILLE, PA.**

Lukens NICKEL-CLAD CLAD INCONEL-CLAD Steels MONEL-CLAD

A new issue of Clad News will be ready shortly. If you are not on the mailing list for this illustrated magazine describing Lukens Clad Steel installations in many industries, write on your letterhead.

ratings, dimensions and layout. Also Bulletin FY103, 4-page folder featuring concern's impact pulverizers for firing cement kilns, including illustrations of typical installations and brief descriptive material.

Pumps. Allis-Chalmers Mfg. Co., Milwaukee, Wis.—Booklet B6059—8 pages which describe and illustrate the range of pumps built by this company. Includes cross-section views, descriptive material on various types, sizes and capacities.

Pumps. Pomona Pump Co., 206 E. Commercial St., Pomona, Calif.—Bulletin 7A257—4-page folder with illustrations and sketches which discusses increased efficiency of this concern's vertical pumps by use of the diffusion "vane shape" design. Discusses operating principles, flow patterns, and efficiencies which are claimed to be increased up to 10 percent.

Refractory Brick. Harbison-Walker Refractories Co., Farmers Bank Bldg., Pittsburgh, Pa.—6-page folder describing this concern's "Korundal" brand of high-alumina (90 percent Al_2O_3) brick. Describes composition, strength and shapes, and presents in graphic form data on the melting behavior of alumina-silica refractories.

Spectographic Equipment. Harry W. Dietert Co., 9330 Roselawn Ave., Detroit, Mich.—4-page folder illustrating and describing briefly this concern's processing equipment for spectro-analysis, metallography, and X-ray. Includes specifications of film developing machine, film washer and dryer, and plate washer and dryer.

Spray Nozzles. Spraying Systems Co., 4021 W. Lake St., Chicago, Ill.—Catalog No. 21—1941 edition devoted to spray nozzles for all industrial uses. Contains illustrations and descriptions of various types, performance tables, and data sheets.

Trucks. Towmotor Co., 1223 E. 152nd St., Cleveland, Ohio—26-page catalog giving detailed specifications on the seven models of gasoline-powered lift trucks of 2,000-10,000 lb. capacities put out by this concern. Includes summary of advantages, descriptive material on each unit, specifications, engineering operating data, and illustrations.

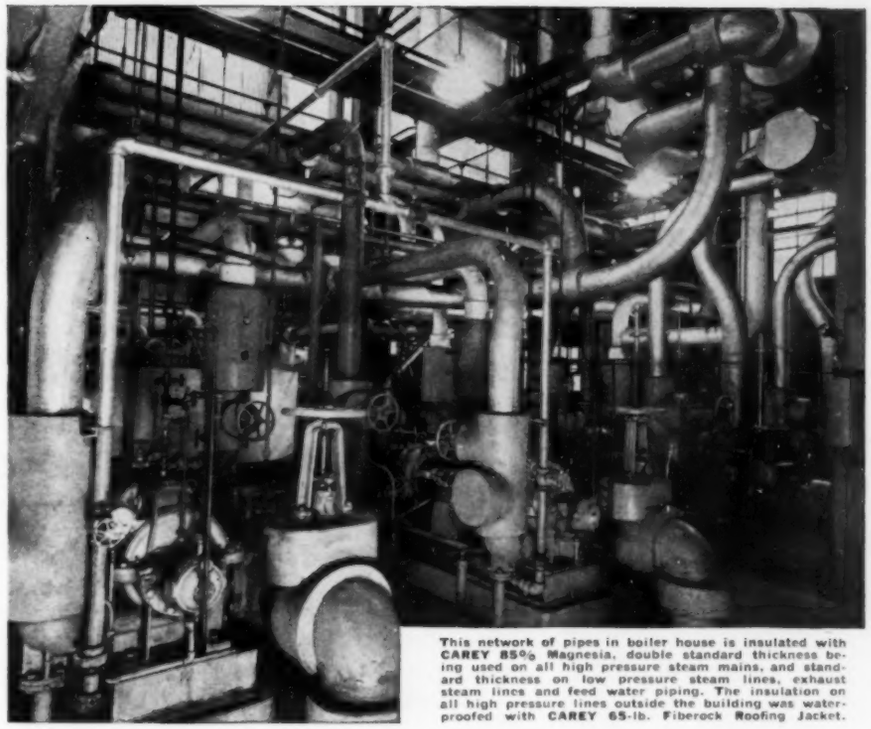
Valves. Yarnell-Waring Co., Chestnut Hill, Philadelphia, Pa.—Bulletin B421—24-page booklet on this concern's blow-off valves for low and medium pressure boilers. Includes cross-sectional photographs of units, materials of construction, specifications, physical and chemical properties, prices, parts prices and similar data.

Vanillin. General Drug Co., 644 Pacific St., Brooklyn, N. Y.—4-page folder briefly telling about this company's recent plant expansions for the production of lignin vanillin, accompanied by photographs of the former and the expanded plant.

Vulcanized Fibre. National Vulcanized Fibre Co., Wilmington, Del.—38-page booklet containing illustrations, technical and descriptive data on this concern's volcanized fibre for electrical, mechanical and other industrial purposes. Photographs show typical applications and products made from the material, and engineering data include information on general properties, machining and forming, standard grades and dimensions of sheets, tubes and rods.

Water Treatment. Cochrane Corp., 17th and Allegheny Aves., Philadelphia, Pa.—Publication 3005—36-page catalog giving a comprehensive treatment of this concern's tray-type deaerators, atomizing deaerators, hot water generators and deaerators, and cold water deaerators. Includes line diagrams on operating features, flow diagrams, appendix on corrosion and pH control, and details of accessory equipment.

Wire Rope. Macwhyte Co., Kenosha, Wis.—Catalog G14—156-page bound notebook with index tabs on this concern's wire rope for various purposes. Includes list prices, tables and engineering data on each of the 1,000 different types.



This network of pipes in boiler house is insulated with **CAREY 85% Magnesia**, double standard thickness being used on all high pressure steam mains, and standard thickness on low pressure steam lines, exhaust steam lines and feed water piping. The insulation on all high pressure lines outside the building was waterproofed with **CAREY 65-lb. Fiberock Roofing Jacket.**

Carey
HEAT INSULATIONS
HELPING PRODUCE
50,000 lbs.-salt per hour
WITH EFFICIENCY
SURPASSING RIGID GUARANTEE

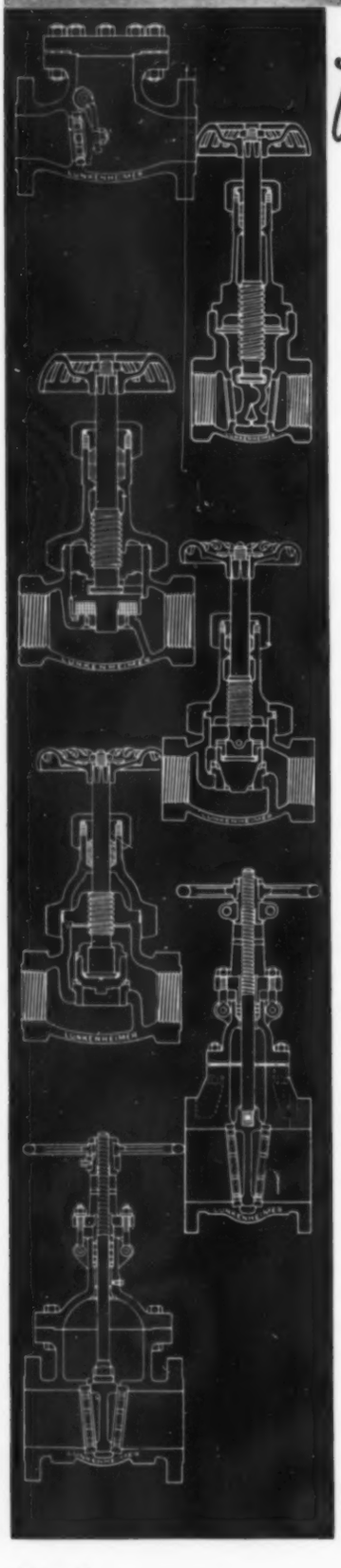
When increasing demand for its product compelled the Worcester Salt Company to expand its plant at Silver Springs, N. Y., it gave the contractor a tough assignment—to install a new boiler with capacity of 150,000 lbs. of steam per hour and guarantee an 86% operating efficiency.

The Riley Stoker Corporation took the contract on the guarantee basis. They knew they could make good by using CAREY Insulations. The equipment was installed and thoroughly insulated with CAREY Products. The efficiency rating, determined by engineers, was 87.3%!

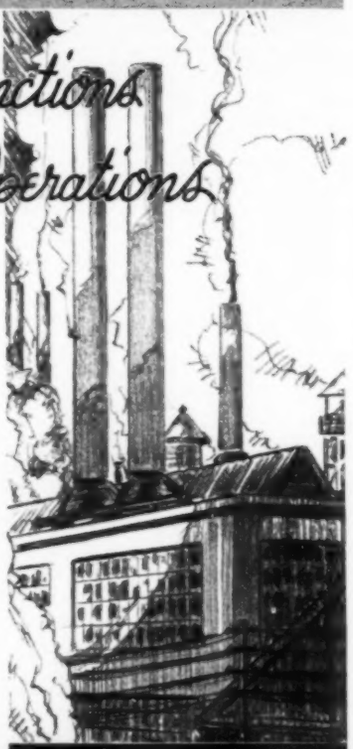
Through constant research, backed by over a half century of manufacturing experience, CAREY Insulations have been developed to the degree of dependability, whereby results can be calculated accurately in advance, thereby eliminating gamble. If you have an insulation problem, put it up to CAREY. A nationwide organization is at your service. Address Dept. 15.

THE PHILIP CAREY MFG. COMPANY • Lockland, Cincinnati, Ohio
Dependable Products Since 1873
IN CANADA: THE PHILIP CAREY COMPANY, LTD. Office and Factory: LENNOXVILLE, P. Q.

LUNKENHEIMER VALVES



Perform important service functions in support of Defense Operations



It's quite natural when thinking of Defense to picture large plants — thousands of machines — and legions of men all busily engaged in the production of munitions, tanks, armored tractors, ships, airplanes and similar war units.

Let's peek behind the scenes at the Power Plants, furnishing the energy for all this defense work. Here, where countless valves control the power that keeps these factories humming, lies a distinct responsibility for maintaining uninterrupted production. Here the selection of the correct valve for the job takes on new values — stamina to stand up over long periods without failure — simplicity of design that insures ease of repair — pretested construction that insures constant service without frequent replacement.

Correctly engineered, rugged Lunkenheimer Valves are a "natural" for this important defense service. The accurate machining of vital parts eliminates excessive wear — reduces maintenance — provides longer life — insures continuous satisfactory service — all distinct aids in maintaining high production in hard-pressed plants.

Thus, in serving industry *better*, Lunkenheimer is helping to conserve both power and materials in the "all out" production for defense needs, and you're helping, too, when you use Lunkenheimer Valves.

Your Lunkenheimer distributor is cooperating in every way to give you the kind of service you so vitally need for the National Defense Program. His facilities will save you time and trouble. . . . . .

28-82A-7

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INDUSTRIAL CONSUMPTION OF CHEMICALS NOW HOLDING AT UNCHANGED LEVEL

Chem & Met ECONOMICS and MARKETS

FROM data available for operations in September, it appears that industrial consumption of chemicals in that month was about the same as that reported for August. Manufacturing rates however have not been constant throughout the consuming industries as some of them have been affected by shortages in raw materials while others are receiving ample supplies. Rubber plants have been forced to curtail activities because of restrictions placed on the amount of crude rubber which the fabricating companies receive. Automotive outputs also are influenced by control over the number of units turned out each month. Paper mills have been very active in recent weeks but consumption of chlorine in pulp manufacture has declined both because of the scarcity of this chemical and because of the agreement to curtail the use of chlorine in bleaching the pulp. Some of the chemicals required in making glass are becoming scarce but so far glass outputs have been of record proportions and it is probable that plate glass demand will be less active over the remainder of the year. In the paint and varnish industry, some of the pigments are not plentiful and makers of chemical colors are reported to have cut manufacturing operations by as much as 20 percent due to inability to obtain necessary raw materials.

On the other hand, more lines have come into operation at smokeless powder plants and new production recently started for some of the other high explosives and it is evident that consumption of chemicals in purely defense plants has increased considerably within the past month. It is now planned to materially increase production of high octane gas for use in the military branches and it is probable that a chlorine plant will be erected to furnish the raw material for the chlorinated solvents which this production will require.

The index for consumption of chemicals in September is 164 which compares with revised numbers of 164.42 and 163.82 for August and July respectively. Last year the corresponding indexes were 140.84, 144.96, and 136.57. Component parts of the index which may be expected to make a good showing over the final quarter include fertilizer, pulp and paper, unless a shortage of pulp appears, petroleum refining, iron and steel, leather, and explosives. Plastics show a spotted condition with some types showing a rise in output and others cut down by material shortages.

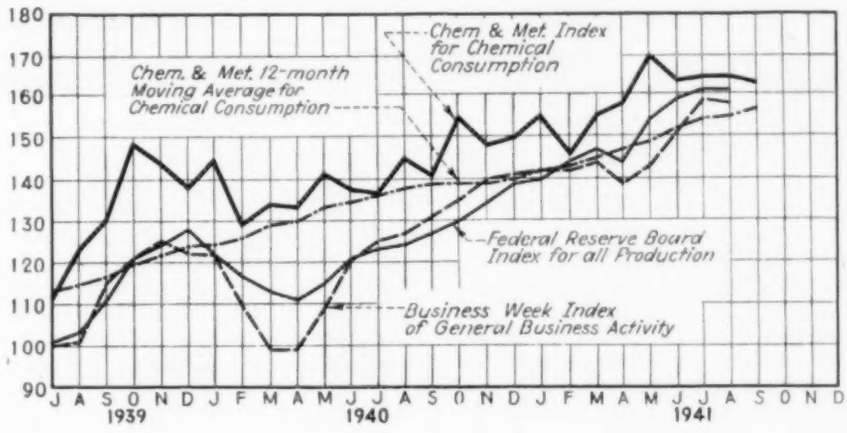
The Department of Commerce has reported that inventories of manufacturers increased sharply in August to all-time high of $13,500,000,000. The increase in August, however, is attributed largely to durable goods industries especially the automotive and finished metal branches. So far as chemical manufacturers are concerned, inventories appear to be small. In most cases, production is moving steadily from plants with supplies not sufficient to take care of all demands.

From the time the defense program was formulated, it has been subjected to upward revisions and this trend appears to be still existent. With the wide extension of the theatre of the war, material demands of the allied forces have increased and if extensive material aid is to be given to Russia, our output of munitions must be speeded up beyond what had been previously regarded as our program and all this means that defense takings of chemicals is slated for a much larger volume than had been anticipated which in turn means that as time goes on the amounts available for some of the civilian lines will be progressively curtailed. In the meantime, export trade in chemicals holds at a high level not only to the warring nations but also to South America.

Current rate of synthetic methanol production is the highest on record with an output of 5,005,840 gal. in August. If present rate is maintained, production this year will be approximately 55,000,000 gal.

Chem. & Met. Index for Industrial Consumption of Chemicals

	July revised	August
Fertilizers	29.82	30.00
Pulp and paper	21.70	22.60
Petroleum refining	15.78	15.97
Glass	14.60	15.40
Paint and varnish	15.90	15.50
Iron and steel	13.13	13.05
Rayon	13.36	13.33
Textiles	11.37	10.76
Coal products	9.33	9.31
Leather	5.06	5.04
Explosives	6.02	6.03
Rubber	4.05	3.76
Plastics	3.70	3.85
	163.82	164.42

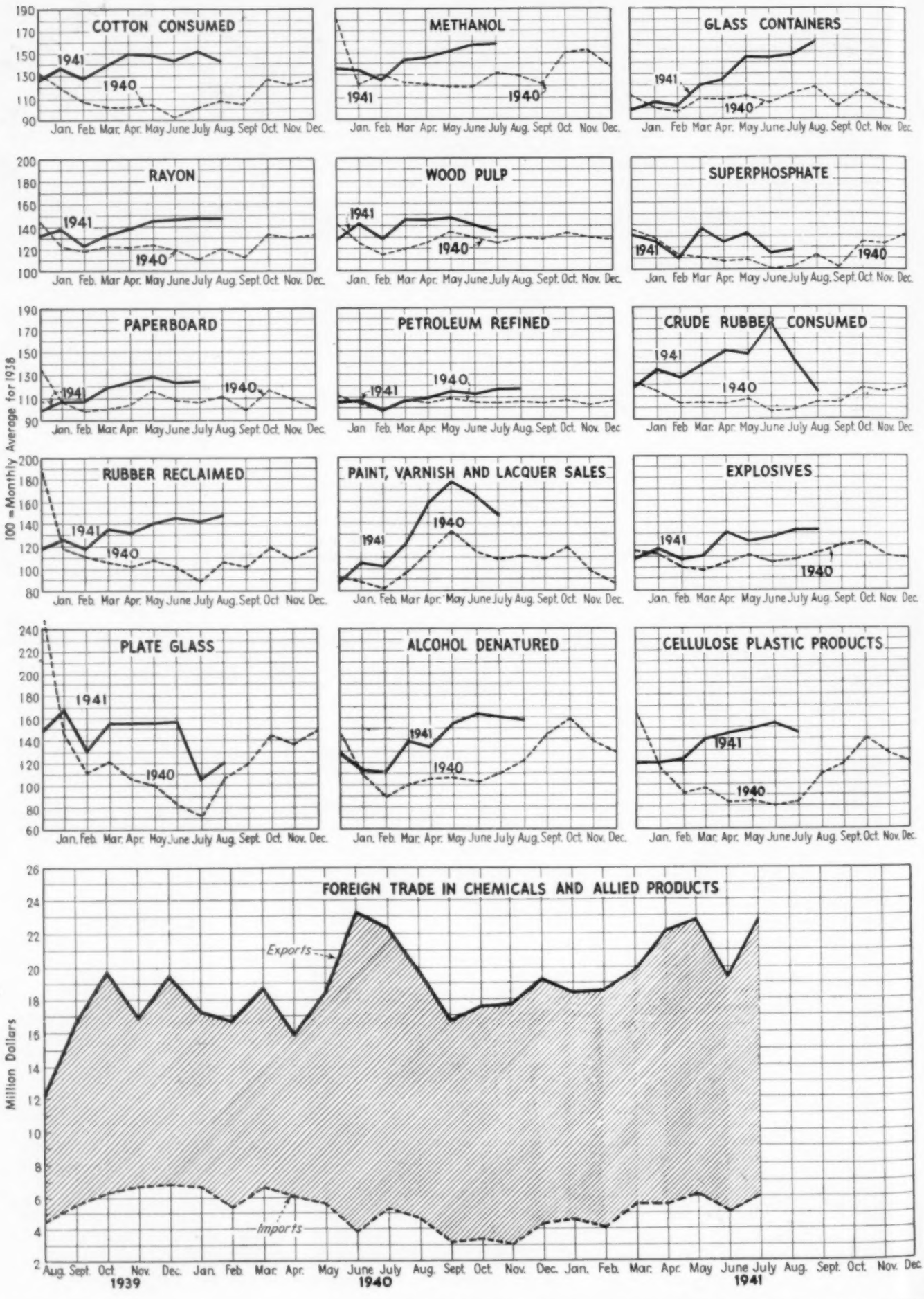

Chem. & Met. Index for Chemical Consumption
Chem. & Met. 12-month Moving Average for Chemical Consumption
Federal Reserve Board Index for all Production
Business Week Index of General Business Activity
180
170
160
150
140
130
120
110
100
90
J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1939
1940
1941

Production and Consumption Data for Chemical-Consuming Industries

	August 1941	August 1940	January-August 1941	January-August 1940	Per cent of gain for 1941
Production					
Alcohol, ethyl, 1,000 pr. gal	34,299	24,094	226,847	171,156	32.5
Alcohol denatured, 1,000 wi. gal	15,065	11,510	107,419	80,072	34.2
Ammonia, liquor, 1,000 lb.[1]	5,540	4,718	42,444	36,566	16.1
Ammonium sulphate, tons[1]	62,418	62,344	493,359	464,351	6.2
Benzol, 1,000 gal.[1]	11,627	11,319	96,528	85,286	13.2
Byproduct coke, 1,000 tons	5,013	4,696	38,617	34,852	10.8
Toluol, 1,000 gal.[1]	2,504	2,324	19,015	.....	....
Naphthalene, 1,000 lb.[1]	7,244	6,773	55,329	.....	....
Glass containers, 1,000 gr.	6,791	5,070	44,829	36,556	22.6
Plate glass, 1,000 sq. ft.	14,126	12,533	135,142	99,660	35.6
Rubber reclaimed, tons	24,065	17,161	177,240	136,417	29.9
Consumption					
Cotton, bales	874,113	654,503	7,008,316	5,128,134	36.7
Silk, bales	2,069	30,189	183,190	184,675	0.8*
Explosives, 1,000 lb	41,363	35,036	297,406	263,846	12.7
Rubber, crude, tons	55,365	53,307	549,196	416,962	31.1
Rubber, reclaimed, tons	20,864	14,464	164,447	124,893	31.7

* Per cent of decline. [1] Production at byproduct coke plants.

Production and Consumption Trends


COTTON CONSUMED
1941
1940
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.
METHANOL
1941
1940
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.
GLASS CONTAINERS
1941
1940
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.
RAYON
1941
1940
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.
WOOD PULP
1941
1940
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.
SUPERPHOSPHATE
1941
1940
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.
PAPERBOARD
1941
1940
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.
PETROLEUM REFINED
1941
1940
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.
CRUDE RUBBER CONSUMED
1941
1940
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.
100 = Monthly Average for 1938
RUBBER RECLAIMED
1941
1940
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.
PAINT, VARNISH AND LACQUER SALES
1941
1940
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.
EXPLOSIVES
1941
1940
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.
PLATE GLASS
1941
1940
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.
ALCOHOL DENATURED
1941
1940
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.
CELLULOSE PLASTIC PRODUCTS
1941
1940
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.
FOREIGN TRADE IN CHEMICALS AND ALLIED PRODUCTS
Million Dollars
Exports
Imports
Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.
1939
1940
1941

WHY THE *Cork Situation* DEMANDS A RESERVE SUPPLY

GLANCE at this map and you will quickly understand why there is a "cork situation" in the United States. All of the world's cork supply comes from the forests indicated by the white dots on this map. It is obvious that present world conditions make the transportation of anything from this area a hazardous undertaking. In spite of the difficulty cork is still coming in. But, the future is another matter, because these ports and waters may later be closed to ordinary commerce.

As a safeguard against such an eventuality, our Government started in June to build a reserve stock pile of cork. Aided by neutral ships and by restrictions governing the usage of available cork in this country, this stock pile is growing steadily but is still less than the tonnage desired. Until this reserve supply is built up to the point considered necessary to insure the safe completion of the nation's defense program, cork will have to be used sparingly. Your Armstrong salesmen may have to ask for your continued patience with delivery delays and usage restrictions.

Our engineers in the field, at headquarters, and in the factory, our laboratory technicians and every staff member—all are doing their best to overcome the difficulties arising from the present situation. There will be no let-up until we can bring to an end the inconveniences and delays you have encountered in securing efficient and dependable insulation for low temperature work.

A large percentage of the corkboard now being manufactured is needed for defense work. What is left over is available primarily for food preservation use. The demand is greater than the supply. For the present, corkboard is not being sold for roof insulation or for duct insulation on air conditioning jobs.

Armstrong's Cork Covering is used largely in defense plants or in plants requiring refrigeration to protect perishable foodstuffs. Due to this fact and because the relatively small amount of cork used has not hindered the Government's cork reserve program we can meet most needs for cork covering.

Whatever your wants may be in the field of insulation for low temperatures, get in touch with us. We may be able either to supply your needs promptly, or help to solve your problem with engineering assistance or with substitute insulation suited to the service. Please call our nearest office or distributor or write Armstrong Cork Company, 919 Concord St., Lancaster, Pennsylvania.

ARMSTRONG CORK COMPANY
Insulation Headquarters

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*Reg. U. S. Pat. Off. O.-C. F. Corp.

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Of

BRASS:

The Fig. 629 nozzle illustrated is of the "non-clog" type; i.e. it contains no internal vanes, slots, or deflectors which might facilitate clogging.

Available ¼" or ⅛" male pipe connection and ¼" to 1" female pipe. (Fig. 631). Small sizes produce a very fine, soft, wide angle spray at low pressures. Capacities 4.7 G.P.H. up.

STONEWARE:

Monarch Fig. 6020 and Fig. 6040 stoneware sprays have replaced most other types of nozzles used in acid chamber plants throughout the world. Last almost indefinitely in sulfur gases and will not break or crack from temperature changes.

STAINLESS:

Available in capacities from .57 g.p.h. (Fig. F-80 style) to 104 G.P.M. (Fig. B-8-A style). "Hollow" cone, "Solid" cone, and "Flat" sprays furnished in pipe sizes and capacities and materials to suit practically any problem where corrosive liquids are sprayed.

Write for Catalogs 6A and 6C

Note: Most metals are under priority, therefore (excepting for very small quantities from stock) preference ratings are usually required.

MONARCH MFG. WKS, INC.

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PHILADELPHIA, PA.

OFFICE OF PRICE ADMINISTRATION MOVES TO PLACE CEILING PRICES ON CHEMICALS

CHIEF interest in the market for chemicals in the last month centered in developments affecting prices. For some time it had been anticipated that higher production costs would force upward revisions when it came time to take up contracts for the final quarter of the year. Hence there was little surprise when higher sales schedules were put into effect for many of the important chemicals even to refined sulphur products which had been affected largely by higher transportation costs.

The second development along price lines came from Washington which established ceiling prices for acetic acid. This followed a previous announcement placing maximum prices on ethyl alcohol. It was further announced that schedules for fixing top prices for wood alcohols and other solvents were in course of preparation. In explanation of the action taken on acetic acid, it was stated that the defense program and a high level of civilian activity have combined to create a substantially increased demand for the acid. Tank car prices for the synthetic product rose from about 5¢ a lb. in the second quarter to 6¢ in the third quarter and a rise to 6½¢ was to be operative in the fourth quarter. Bulk price for the natural product in the same period rose from around 5¢ to 10¢ and even higher. Exploration by OPA, which included a conference with representatives of the industry, disclosed no justifiable reasons why acetic acid prices should be allowed to rise above third quarter levels. Maximum prices established in the schedule are 7½¢ a lb. for acetic acid of wood origin and 6½¢ for the synthetic type when sold in tank cars. These are delivered prices and refer to glacial acetic and to weaker acids expressed in terms of 100 percent. The statement credited production of synthetic acid in the present year at 165,000,000 lb. of which only about 45,000,000 lb. will reach the open market. Production of natural acid is placed at 55,000,000 lb. most of which is offered for sale.

To date there has been no control exercised over prices for vegetable oils and the trend has continued upward both for oils and animal fats. Soap makers are credited with large purchases of tallow recently at a price of 9¢ a lb. Chinawood oil is in a nominal position and the large demand which has arisen for dehydrated castor oil to replace the China product has been greater than crushers could supply. Furthermore, costs for Brazilian seed were advanced and this necessitated a higher schedule for the oil. Linseed oil has been finding a better market but the seed supply is larger than normal and values have been kept on a fairly stable basis.

In connection with anti-freeze supplies for the coming season, it is of interest to note that the output of industrial alcohol in August reached the all-time high total of 34,299,071 proof gal. and as production on the part of the distilling industry will be speeded up by November, the outlook for anti-freeze alcohol is considerably improved despite the fact that smokeless powder plants are now operating in a larger way.

Officials of the Defense organization are much concerned that many small industries are being made victims of commodity marketers who are evading or violating the law. Some of the recent cases brought by the Department of Justice against chemical marketers illustrate one of the means chosen to eliminate these backdoor operators. Officials of the Office of Production Management and the Office of Price Administration are collaborating in formulating other methods.

The way some of these concerns work is interesting. This seems to be a typical plan: A concern is organized for the marketing of some commodity, often chemicals. It undertakes to buy goods claiming for "defense" usage. Then it scouts around for small firms who will have difficulty in getting these chemicals because they have not traded with any manufacturer regularly. The new dealer usually finds that the small-buyer concerns urgently need a very small quantity of some scarce chemical. Without it they are in danger of shutting down. Thus the would-be buyer is willing to pay almost any price for a few drums of alcohol or a few gallons of some other scarce material.

"There is no need of trading with these profiteers." This is the categoric statement of responsible officials. Each concern having a legitimate need for small quantities of chemicals will be taken care of if it demonstrates the necessity for a supply. The OPM Chemical Division is referring such inquirers to producers and having them cared for without elaborate formality. Any small firm having difficulty with a minor item of chemical supply need only call on the Chemical

CHEM. & MET.
Weighted Index of
CHEMICAL PRICES

Base = 100 for 1937

This month	**104.05**
Last month	103.42
October, 1940	99.24
October, 1939	97.56

Contract prices for the Oct.-Dec. quarter were advanced in several cases and the average price level continued to rise. Production is well sold ahead and with rising production costs, a strong price tone runs through the market.

Division, Office of Production Management, to insure prompt and sympathetic attention. If the goods require a priority order, suitable arrangements will be made with the Priorities Division.

Officials of the OPA are urging that those who complain of price rises do so only after they have undertaken to protect themselves in these matters. Recent chief of the OPA Chemicals Division, Dr. T. J. Kreps, says: "It is their own fault if these little fellows pay too much. The remedy is, obviously, to deal through legitimate brokers and manufacturers, requesting official aid when needed on goods subject to priority control. Self-protection should dictate the use of government cooperation, instead of questionable arrangements in dealing with these irresponsible contractors in chemical marketing."

The American Consulate at Fortaleza, Brazil, in a report covering the carnauba wax industry states that a preliminary estimate of the new wax crop will be very large. According to the estimate, 5,000 tons will be produced in the State of Ceara which compares with a total output of 3,452 tons in 1940. The Brazilian Government, on account of low stocks, authorized producers to start cutting the leaves earlier this year and as a result the new crop of wax will be on the market in September.

Exporters of the wax in Brazil are reported anxious to see prices go down to normal, because they must take higher risks and are not making an extra margin of profit. The price quoted in Brazil for North Country No. 3 grade of carnauba wax (new crop) for November shipment is 65¢ per pound, it was said.

The United States is practically the only market now for the wax, and with a bigger crop this year, greater quantities should be available. Total exports of carnauba wax from Brazil in 1940 were 8,653 metric tons, of which 7,568 metric tons went to the United States. Imports of the wax into the United States for the first six months of 1941 advanced to 13,948,409 pounds, valued at $7,655,219 from 11,531,274 pounds, valued at $5,006,918 for the same period of 1940.

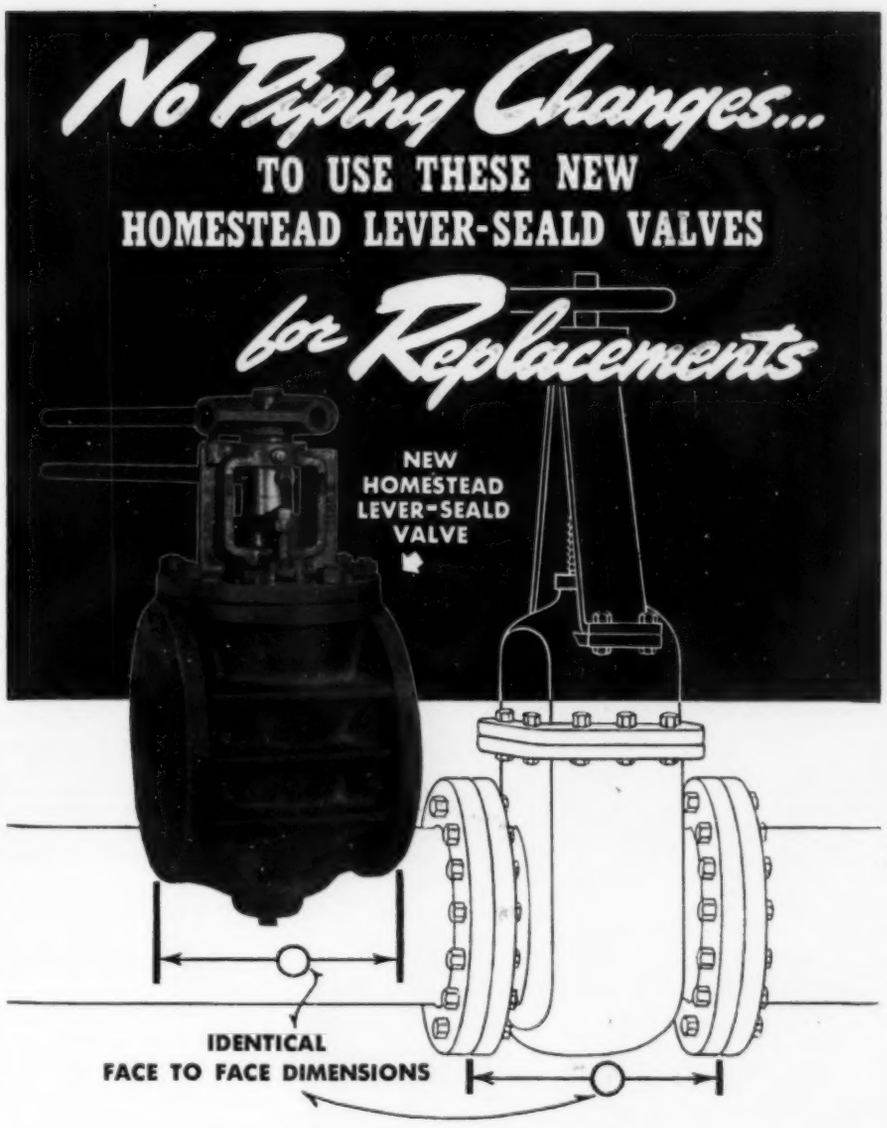
CHEM. & MET.

Weighted Index of Prices for OILS & FATS

Base=100 for 1937

This month	135.22
Last month	127.37
October, 1940	66.95
October, 1939	82.15

The upward price trend for oils and fats is unchecked. Crude cottonseed oil has been affected by higher prices for seed. Chinawood oil imports are small and castor oil which is used as a substitute was marked up during the month.



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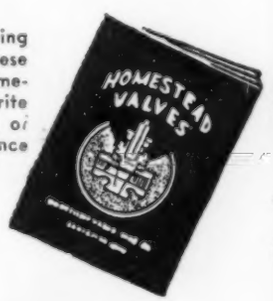
For engineering facts about these and other Homestead Valves, write for your copy of Valve Reference Book No. 38.



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P.O. BOX 13 **CORAOPOLIS, PA.**

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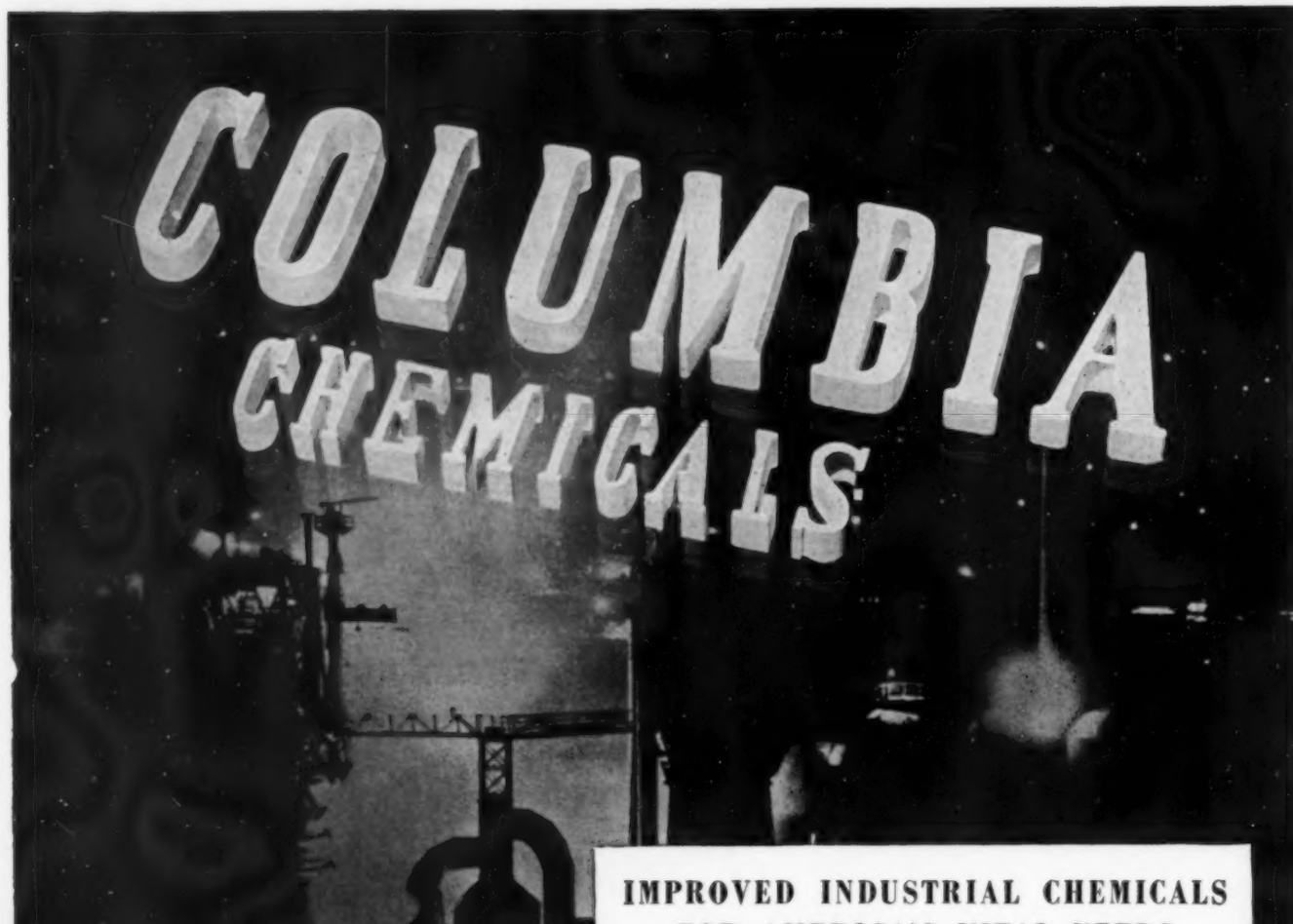

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INDUSTRIAL	SILENE • CALCIUM CHLORIDE • SODA BRIQUETTES • MODIFIED SODAS
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Columbia Chemical Division

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INDUSTRIAL CHEMICALS

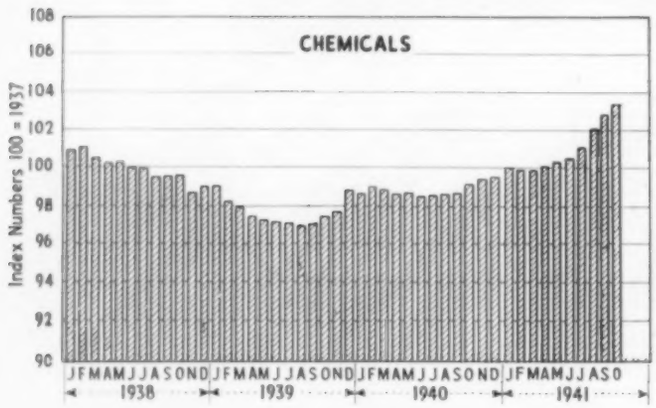
	Current Price	Last Month	Last Year
Acetone, drums, lb.	$0.09½–$0.10	$0.08½–$0.09	$0.07½–$0.08
Acid, acetic, 28%, bbl., cwt.	3.18 – 3.43	3.18 – 3.43	2.23 – 2.48
Glacial 99.5%, drums	8.68 –10.00	8.68 –10.00	8.43 – 8.68
U. S. P. X1, 99.5%, dr.	10.50 –11.00	10.50 –11.00	10.25 –10.50
Boric, bbl., ton	106.00–111.00	106.00–111.00	106.00–111.00
Citric, kegs, lb	.20 – .23	.20 – .23	.20 – .23
Formic, cbys., lb	.10½– .11	.10½– .11	.10½– .11
Gallic, tech., bbl., lb.	1.05 – 1.15	1.05 – 1.15	.90 – 1.00
Hydrofluoric 30% drums, lb.	.08 – .08½	.08 – .08½	.08 – .08½
Lactic, 44%, tech., light, bbl., lb.	.06½– .06¾	.06½– .06¾	.06½– .06¾
Muriatic, 18°, tanks, cwt.	1.05 –	1.05 –	1.05 –
Nitric, 36°, carboys, lb.	.05 – .05½	.05 – .05¼	.05 – .05½
Oleum, tanks, wks., ton	18.50 –20.00	18.50 –	18.50 –20.00
Oxalic, crystals, bbl., lb.	.11¼– .13	.10¾– .12	.10¾– .12
Phosphoric, tech., c'bys., lb.	.07½– .08½	.07½– .08½	.07½– .08½
Sulphuric, 60°, tanks, ton	13.00 –	13.00 –	13.00 –
Sulphuric, 66°, tanks, ton	16.50 –	16.50 –	16.50 –
Tannic, tech., bbl., lb.	.66 – .68	.64 – .66	.54 – .56
Tartaric, powd., bbl., lb.	.70 –	.63 –	.41¼–
Tungstic, bbl., lb.	nom	nom	nom
Alcohol, amyl	–	–	–
From Pentane, tanks, lb.	.131–	.121–	.101–
Alcohol, Butyl, tanks, lb.	.11 –	.10 –	.09 –
Alcohol, Ethyl, 190 p'f., bbl., gal.	6.04 –	6.04 –	5.98 –
Denatured, 190 proof	–	–	–
No. 1 special, dr., gal. wks.	.33 –	.33 –	.29½–
Alum, ammonia, lump, bbl., lb.	.03¾– .04	.03¾ .04	.03½– .04
Potash, lump, bbl., lb.	.04 – .04¼	.04 – .04¼	.03¾– 04
Aluminum sulphate, com. bags, cwt.	1.15 – 1.40	1.15 – 1.40	1.15 – 1.40
Iron free, bg., cwt.	1.85 – 2.10	1.85 – 2.10	1.60 – 1.70
Aqua ammonia, 26°, drums, lb.	.02½– .03	.02½– .03	.02½– .03
tanks, lb.	.02 – .02¼	.02 – .02¼	.02 – .02¼
Ammonia, anhydrous, cyl., lb.	.16 –	.16 –	.16 –
tanks, lb.	.04½–	.04½–	.04½–
Ammonium carbonate, powd. tech., casks, lb.	.09 – .12	.09 – .12	.09 – .12
Sulphate, wks., cwt.	1.45 –	1.45 –	1.40 –
Amylacetate tech., from pentane, tanks, lb.	.135–	.115–	.115–
Antimony Oxide, bbl., lb.	.13–	.13 –	.13 –
Arsenic, white, powd., bbl., lb.	.04 – .04½	.04 – .04½	.03 – .03¼
Red, powd., kegs, lb.	nom	nom	.17 – .18
Barium carbonate, bbl., ton	60.00 –65.00	55.00 –60.00	52.50 –57.50
Chloride, bbl., ton	79.00 –81.00	79.00 –81.00	79.00 –81.00
Nitrate, casks, lb.	.10½– .11	.09½– .10	.08½– .10
Blanc fixe, dry, bbl., lb.	.03½– .04	.03½– .04	.03½– .04
Bleaching powder, f.o.b., wks., drums, cwt.	2.00 – 2.10	2.00 – 2.10	2.00 – 2.10
Borax, gran., bags, ton	43.00 –	43.00 –	43.00 –51.00
Bromine, cs., lb.	.30 – .32	.30 – .32	.30 – .32
Calcium acetate, bags	3.00 –	3.00 –	1.90 –
Arsenate, dr., lb.	.07½– .07¾	.07½– .07¾	.06½– .06¾
Carbide drums, lb.	.04½– .05	.04½– .05	.04½– .05
Chloride, fused, dr., del., ton	19.00 –24.50	19.00 –24.50	19.00 –24.50
flake, dr., del., ton	20.50 –25.00	20.50 –25.00	20.50 –25.00
Phosphate, bbl., lb.	.07½– .08	.07½– .08	.07½– .08
Carbon bisulphide, drums, lb.	.05½–	.05 –	.05 –
Tetrachloride drums, gal.	.73 – .80	.73 – .80	.66½– .73
Chlorine, liquid, tanks, wks., lb.	2.00 –	2.00 –	1.75 –
Cylinders	.05½– .06	.05½– .06	.05½– .06
Cobalt oxide, cans, lb.	1.84 – 1.87	1.84 – 1.87	1.84 – 1.87
Copperas, bgs., f.c.b. wks, ton	18.00 –19.00	18.00 –19.00	18.00 –19.00
Copper carbonate, bbl., lb.	.18 – .20	.18 – .20	.10 – .16
Sulphate, bbl., cwt.	5.00 – 5.25	5.00 – 5.25	4.75 – 5.00
Cream of tartar, bbl., lb.	.57 –	.52 –	.34½–
Diethylene glycol, dr., lb.	.22 – .23	.22 – .23	.22 – .23
Epsom salt, dom., tech., bbl., cwt.	1.90 – 2.00	1.90 – 2.00	1.80 – 2.00
Ethyl acetate, drums, lb.	.09½–	.08½–	.07 –
Formaldehyde, 40%, bbl., lb.	.05½– .06	.05½– .06¼	.05½– .06
Furfural, tanks, lb.	.09 –	.09 –	.09 –
Fusel oil, drums, lb.	.17½– .19	.17½– .19	.16 – .17
Glaubers salt, bags, cwt.	1.05 – 1.10	1.05 – 1.10	.95 – 1.00
Glycerine, c.p., drums, extra, lb.	.19½–	.14½–	.12½–
Lead:			
White, basic carbonate, dry casks, lb.	.07½–	.07½–	.07 –
White, basic sulphate, sck., lb.	.07½–	.07½–	.06½–
Red, dry, sck., lb.	.0835	.0835	.07½–
Lead acetate, white crys., bbl., lb.	.12 – .13	.12 – .13	.11 – .12
Lead arsenate, powd., bag, lb.	.09½– .11	.09½– .11	.08½– .11
Lime, chem., bulk, ton	8.50 –	8.50 –	8.50 –
Litharge, pwd., csk., lb.	.0735	.0735	.06½–
Lithopone, bags, lb.	.0385– .04	.0385– .04	.036– .04
Magnesium carb., tech., bags, lb.	.06¼– .06½	.06¼– .06½	.06¼– .06½
Methanol, 95%, tanks, gal.	.73 –	.73 –	.29 –
97%, tanks, gal.	.75 –	.75 –	.30 –
Synthetic, tanks, gal.	.28 –	.30 –	.30 –
Nickel salt, double, bbl., lb.	.13½– .13¾	.13½– .13¾	.13 – .13¼
Orange mineral, csk., lb.	.11½–	.11½–	.10½–
Phosphorus, red, cases, lb.	.40 – .42	.40 – .42	.40 – .42
Yellow, cases, lb.	.18 – .25	.18 – .25	.18 – .25
Potassium bichromate, casks, lb.	.09½– .10	.09½– .10	.08½– .09
Carbonate, 80–85%, calc. csk., lb.	.06½– .07	.06½– .07	.06½– .07
Chlorate, powd., lb.	.10 – .12	.10 – .12	.10 – .12
Hydroxide (c'stic potash) dr., lb.	.07 – .07¼	.07 – .07¼	.07 – .07¼
Muriate, 60% bags, unit	.53½–	.53½–	.53½–
Nitrate, bbl., lb.	.05½– .06	.05½– .06	.05½– .06
Permanganate, drums, lb.	.19½– .20	.19½– .20	.18½– .19
Prussiate, yellow, casks, lb.	.17 – .18	.17 – .18	.15 – .16
Sal ammoniac, white, casks, lb.	.0515– .06	.0515– .06	.05½– .06
Salsoda, bbl., cwt.	1.00 – 1.05	1.00 – 1.05	1.00 – 1.05
Salt cake, bulk, ton	17.00 –	17.00 –	23.00 –
Soda ash, light, 58%, bags, contract, cwt.	1.05 –	1.05 –	1.05 –
Dense, bags, cwt.	1.10 –	1.10 –	1.10 –
Soda, caustic, 76%, solid, drums, cwt.	2.30 – 3.00	2.30 – 3.00	2.30 – 3.00
Acetate, del., bbl., lb.	.04½– .06	.04½– .06	.04 – .05
Bicarbonate, bbl., cwt.	1.70 – 2.00	1.70 – 2.00	1.70 – 2.00
Bichromate, casks, lb.	.07½– .08	.07½– .08	.06¼– .07
Bisulphate, bulk, ton	16.00 –17.00	16.00 –17.00	15.00 –16.00
Bisulphite, bbl., lb.	.03 – .04	.03 – .04	.03 – .04
Chlorate, kegs, lb.	.06½– .06½	.06½– .06½	.06½– .06½
Cyanide, cases, dom., lb.	.14 – .15	.14 – .15	.14 – .15
Fluoride, bbl., lb.	.08 – .09	.08 – .09	.07 – .08
Hyposulphite, bbl., cwt.	2.40 – 2.50	2.40 – 2.50	2.40 – 2.50
Metasilicate, bbl., cwt.	2.50 – 2.65	2.35 – 2.40	2.35 – 2.40
Nitrate, bulk, cwt.	1.47 –	1.47 –	1.45 –
Nitrite, casks, lb.	.06½– .07	.06½– .07	.06½– .07
Phosphate, tribasic, bags, lb.	2.35 –	2.35 –	2.25 –
Prussiate, yel. drums, lb.	.10½– .11	.10½– .11	.10½– .11
Silicate (40° dr.) wks., cwt.	.80 – .85	.80 – .85	.80 – .85
Sulphide, fused, 60–62%, dr. lb.	.03 – .03½	.03 – .03½	.02½– .03
Sulphite, crys., bbl., lb.	.02½– .02¾	.02½– .02¾	.02½– .02¾
Sulphur, crude at mine, bulk, ton	16.00 –	16.00 –	16.00 –
Chloride, dr., lb.	.03 – .04	.03 – .04	.03 – .04
Dioxide, cyl., lb.	.07 – .08	.07 – .08	.07 – .07¼
Flour, bag, cwt.	1.60 – 3.00	1.60 – 3.00	1.60 – 3.00
Tin Oxide, bbl., lb.	.55 –	.55 –	.54 –
Crystals, bbl., lb.	.39½–	.39½–	.38½–
Zinc, chloride, gran., bbl., lb.	.05 – .06	.05 – .06	.05 – .06
Carbonate, bbl., lb.	.14 – .15	.14 – .15	.14 – .15
Cyanide, dr., lb.	.33 – .35	.33 – .35	.33 – .35
Dust, bbl., lb.	.09½–	.09½–	.09½–
Zinc oxide, lead free, bag, lb.	.06½–	.06½–	.06½–
5% lead sulphate, bags, lb.	.06½–	.06½–	.06½–
Sulphate, bbl., cwt.	3.40 – 3.50	3.15 – 3.25	2.75 – 3.00

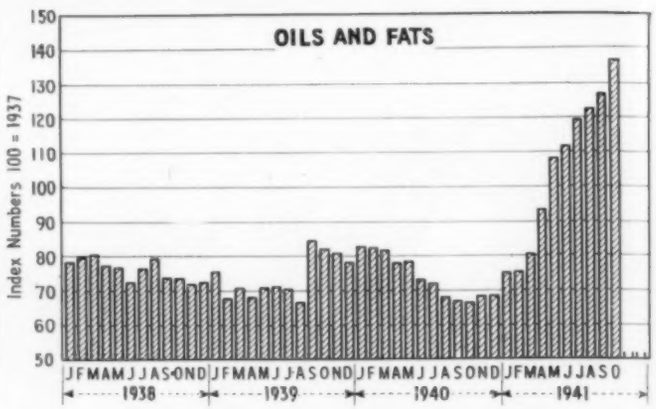
The accompanying prices refer to round lots in the New York market. Where it is the trade custom to sell f.o.b. works, quotations are given on that basis and are so designated. Prices are corrected to October 10

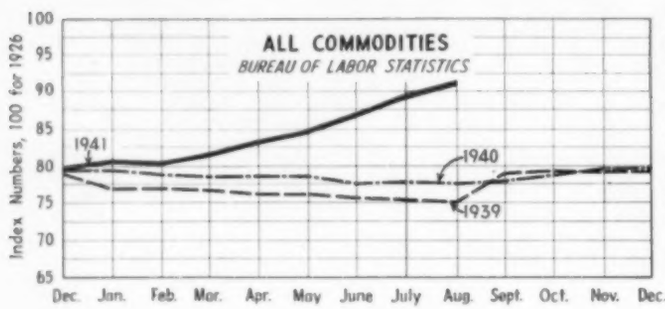
OILS AND FATS

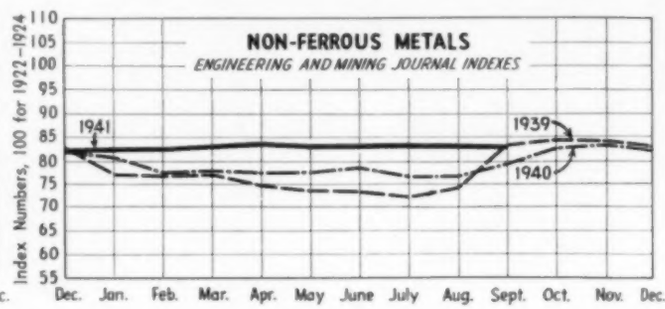
	Current Price	Last Month	Last Year
Castor oil, 3 bbl., lb.	$0.12½–$0.13	$0.11½–$0.12	$0.10½ –$0.11
Chinawood oil, bbl., b.	.34 –	.34 –	.26 –
Coconut oil, Ceylon, tank, N. Y., lb.	.07½–	.07½–	.02½–
Corn oil crude, tanks (f.o.b. mill), lb.	.12½–	.11½–	.05½–
Cottonseed oil, crude (f.o.b. mill), tanks, lb.	.12½–	.12½–	.04½–
Linseed oil, raw car lots, bbl., lb.	.113–	.113–	.083–
Palm, casks, lb.	.08½–	.08 –	.03½–
Peanut oil, crude, tanks (mill), lb.	.13 –	.11½–	.05½–
Rapeseed oil, refined, bbl., lb.	.15½–	.15½–	.12 –
Scya bean, tank, lb.	.11 –	.09½–	.03½–
Sulphur (olive foots), bbl., lb.	.16 –	.16 –	.09½–
Cod, Newfoundland, bbl., gal.	nom	nom	nom
Menhaden, light pressed, bbl., lb.	.112–	.106–	.061–
Crude, tanks (f.o.b. factory), gal.	.60 –	.60 –	.21 –
Grease, yellow, loose, lb.	.08½–	.08½–	.03½–
Oleo stearine, lb.	.09½–	.09½–	.05½–
Oleo oil, No. 1	.11½–	.11½–	.05½–
Red oil, distilled, dp.p. bbl., lb.	.12 –	.10½–	.06½–
Tallow extra, loose, lb.	.09 –	.08½–	.03½–

Chem. & Met.'s Weighted Price Indexes








NON-FERROUS METALS
ENGINEERING AND MINING JOURNAL INDEXES
Index Numbers, 100 for 1922–1924
1941
1939
1940
Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.

Coal-Tar Products

	Current Price	Last Month	Last Year
Alpha-napthol, crude bbl., lb.	$0.52 –$0.55	$0.52 –$0.55	$0.52 –$0.55
Alpha-naphthylamine, bbl., lb.	.32 – .34	.32 – .34	.32 – .34
Aniline oil, drums, extra, lb.	.15 – .16	.15 – .16	.15 – .16
Aniline, salts, bbl., lb.	.22 – .24	.22 – .24	.22 – .24
Benzaldehyde, U.S.P., dr., lb.	.85 – .95	.85 – .95	.85 – .95
Benzidine base, bbl., lb.	.70 – .75	.70 – .75	.70 – .75
Benzoic acid, U.S.P., kgs., lb.	.54 – .56	.54 – .56	.54 – .56
Benzyl chloride, tech., dr., lb.	.23 – .25	.23 – .25	.23 – .25
Benzol, 90%, tanks, works, gal.	.14 –	.14 –	.14 – .....
Beta-napthol, tech., drums, lb.	.23 – .24	.23 – .24	.23 – .24
Cresol, U.S.P., dr., lb.	.10½– .11	.10½– .10½	.09½– .10
Cresylic acid, dr., wks., gal.	.81 – .83	.76 – .78	.58 – .60
Diethylaniline, dr., lb.	.40 – .45	.40 – .45	.40 – .45
Dinitrophenol, bbl., lb.	.23 – .25	.23 – .25	.23 – .25
Dinitrotoluol, bbl., lb.	.18 – .19	.18 – .19	.15½– .16
Dip oil, 15%, dr., gal.	.23 – .25	.23 – .25	.23 – .25
Diphenylamine, dr. fob wks., lb.	.70 –	.70 –	.....
H-acid, bbl., lb.	.45 – .50	.45 – .55	.45 – .50
Naphthalene, flake, bbl., lb.	.07 – .07½	.07 – .07½	.07 – .07½
Nitrobenzene, dr., lb.	.08 – .09	.08 – .09	.08 – .09
Para-nitraniline, bbl., lb.	.47 – .49	.47 – .49	.47 – .49
Phenol, U.S.P., drums, lb.	.13 –	.12½–	.13 – .....
Picric acid, bbl., lb.	.35 – .40	.35 – .40	.35 – .40
Pyridine, dr., gal.	1.70 – 1.80	1.70 – 1.80	1.70 – 1.80
Resorcinol, tech., kegs, lb.	.75 – .80	.75 – .80	.75 – .80
Salicylic acid, tech., bbl., lb.	.33 – .40	.33 – .40	.33 – .40
Solvent naptha, w.w., tanks, gal.	.27 –	.27 –	.27 – .....
Tolidine, bbl., lb.	.86 – .88	.86 – .88	.86 – .88
Toluol, drums, works, gal.	.32 –	.30 –	.30 – .....
Xylol, com, tanks, gal.	.26 –	.26 –	.26 – .....

Miscellaneous

	Current Price	Last Month	Last Year
Barytes, grd., white, bbl., ton.	$22.00–$25.00	$22.00–$25.00	$22.00–$25.00
Casein, tech, bbl, lb.	.26½– .30	.29 – .31	.11½– .13
China clay, dom., f.o.b. mine, ton.	8.00 –20.00	8.00 –20.00	8.00 –20.00
Dry colors			
Carbon gas, black (wks.), lb.	.0335– .30	.0335– .30	.028– .30
Prussian blue, bbl., lb.	.36 – .37	.36 – .37	.36 – .37
Ultramarine blue, bbl., lb.	.11 – .26	.11 – .26	.10 – .26
Chrome green, bbl., lb.	.21½– .30	.21½– .30	.21 – .27
Carmine, red, tins, lb.	4.60 – 4.75	4.60 – 4.75	4.85 – 5.00
Para toner, lb.	.75 – .80	.75 – .80	.75 – .80
Vermilion, English, bbl., lb.	3.20 – 3.25	3.20 – 3.25	nom
Chrome yellow, C.P., bbl., lb.	.14½– .15½	.14½– .15½	.14½– .15½
Feldspar, No. 1 (f.o.b.N.C.), ton.	6.50 – 7.50	6.50 – 7.50	6.50 – 7.50
Graphite, Ceylon, lump, bbl., lb.	.08 – .10	.08 – .10	.06 – .06½
Gum copal Congo, bags, lb.	.09 – .30	.09 – .30	.06 – .30
Manila, bags, lb.	.09 – .15	.09 – .14	.09 – .14
Damar, Batavia, cases, lb.	.10 – .22	.10 – .20	.08 – .24
Kauri, cases, lb.	.18 – .60	.18 – .60	.18½– .60
Kieselguhr (f.o.b. mines), ton.	7.00 –40.00	7.00 –40.00	7.00 –40.00
Magnesite, calc, ton	65.00 –	65.00 –	65.00 – .....
Pumice stone, lump, bbl., lb.	.05 – .07	.05 – .08	.05 – .07
Imported, casks, lb.	nom	nom	.03 – .04
Rosin, H., 100 lb.	3.10 –	3.12 –	2.22 – .....
Turpentine, gal.	.83 –	.81 –	.40 – .....
Shellac, orange, fine, bags, lb.	.38 –	.38 –	.26 – .....
Bleached, bonedry, bags, lb.	.35 –	.35 –	.23 – .....
T. N. Bags, lb.	.28 –	.28 –	.13 – .....
Soapstone (f.o.b. Vt.), bags, ton.	10.00 –12.00	10.00 –12.00	10.00 –12.00
Talc. 200 mesh (f.o.b. Vt.), ton.	8.00 – 8.50	8.00 – 8.50	8.00 – 8.50
200 mesh (f.o.b. Ga.), ton.	6.00 – 8.00	6.00 – 8.00	7.50 –11.00

Industrial Notes

PITTSBURGH EQUITABLE METER CO., Pittsburgh, has moved its offices and warehouse in Los Angeles to 3136 East Eleventh St. H. Boezinger, vice-president, is in charge of west coast sales.

FEDDERS MFG. CO., INC., Buffalo, has promoted Edmund R. Walker to assistant general manager. He is succeeded as sales manager of the air conditioning division by Clarence E. Scott.

CORROSION CONTROL CORP., Norwalk, Conn., has moved its offices, laboratory, and manufacturing equipment to 34 Smith St.

ARTHUR L. STERN, South Orange, N. J., has moved his branch office in Philadelphia to 401 North Broad St.

THE REINEVELD CORP., Philadelphia, Pa., manufacturers of horizontal bulk centrifugals and separators which were described on pp. 690-1 of our November 1939 issue, announces that arrangements have been completed to build machines of several designs in the United States. Reineveld centrifugals were formerly made in Delft, Holland. Production in the plant of Welding Engineers Inc., Philadelphia, will commence about Dec. 1.

DEWEY & ALMY CHEMICAL CO., Cambridge, Mass., has appointed S. T. Dahl Co., Los Angeles, as its sales representative for adhesives in southern California.

JOSEPH T. RYERSON & SON, Chicago, announce that its vice-president W. F. Kurfess has been called to active naval duty and is in charge of the steel division of the Bureau of Ships at Washington.

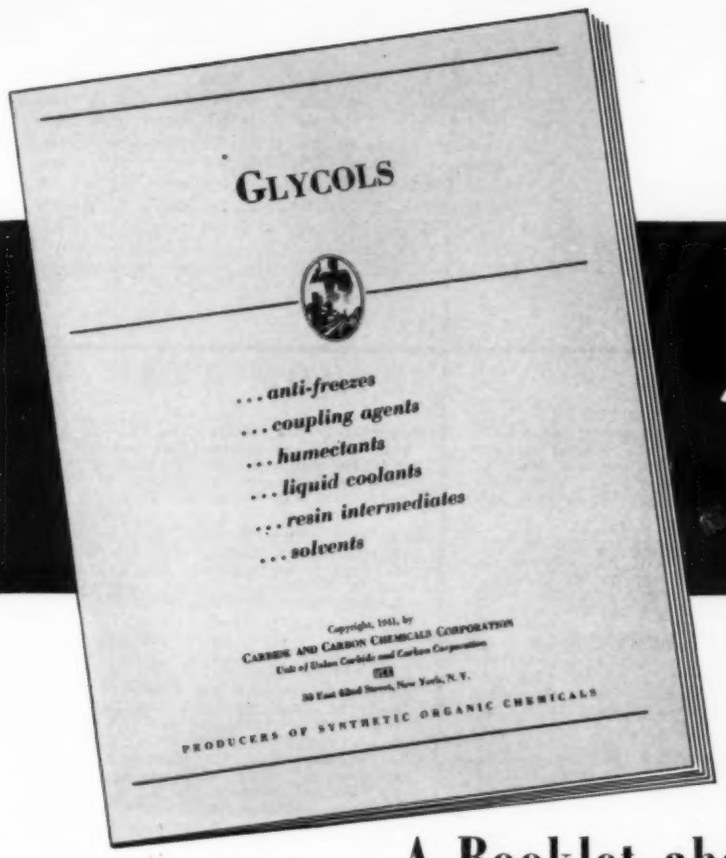
MERCK & CO., Rahway, N. J., has added C. G. Vaupel to its general sales and technical service division.

CARDOX CHEMICAL CO., Chicago, will add a unit to its plant at Claremore, Okla., for the production of perchlorate of potash.

UNION POTASH & CHEMICAL CO., Chicago, has moved its sales office in Atlanta, Ga., to the Volunteer Bldg.

CHICAGO PNEUMATIC TOOL CO., Chicago, has purchased the plant at Garfield, N. J., formerly operated by the Champlain Corp.

THE MICHIGAN CHEMICAL CORP., St. Louis, has opened a branch office in Jersey City with Phil LoBue in charge.



New...

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IT isn't a very thick booklet, but it's packed full of useful information. It condenses under one cover for the first time all the information we have available about our glycols—names, formulas, physical and chemical properties, uses, special graphical data, and literature references. This booklet covers one of the many groups of synthetic aliphatic organic chemicals that we produce. You should have it in your files for ready reference.

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COMPANY.....

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Chem & Met New CONSTRUCTION

	Current Projects		Cumulative 1941	
	Proposed Work	Contracts	Proposed Work	Contracts
New England	$90,000	$90,000	$2,915,000	$4,428,000
Middle Atlantic	.....	1,830,000	27,600,000	35,352,000
South	2,230,000	16,500,000	45,823,000	230,576,000
Mid ile West	16,000,000	1,035,000	20,805,000	154,608,000
West of Mississippi	250,000	111,717,000	58,055,000	246,710,000
Far West	40,000	45,000	13,262,000	52,276,000
Canada	300,000	179,000	2,272,000	2,114,000
Total	$18,910,000	$131,396,000	$170,732,000	$726,064,000

PROPOSED WORK

Calif., San Francisco—Ready Mixed Concrete, Mariposa and Wisconsin Sts., San Francisco, plans to construct plant and storage additions. Estimated cost $40,000.

Louisiana—Premier Refining Co., Longview, Tex., J. R. Parten, Second Natl. Bank Bldg., Houston, Chn. of the Bd., plans to construct an aviation gasoline plant in Webster Parish. Estimated cost $1,730,000.

Mass., Framingham—Hodgman Rubber Co., Herbert St., plans to construct an addition to its mill to include churn compound plant. Contract for same will soon be awarded by I. Richmond, Archt., 248 Boylston St. Estimated cost $40,000.

Mass., West Boylston—Shell Oil Co., Inc., 49 West 49th St., New York, N. Y., will soon award the contract for an oil terminal bulk plant here. G. M. Ramsey, 50 West 50th St., New York, N. Y., Engr. Estimated cost $50,000.

O., Painesville—Diamond Alkali Corp., Fairport Harbor, O., plans to construct a magnesium plant here. Project will be financed by Defense Plant Corp., Wash., D. C. Estimated cost $16,000,000.

Okla., Claremore—Cardox Corp., 307 North Michigan Ave., Chicago, Ill., plans to construct a potassium perchlorate plant here. Estimated cost $250,000.

Va., Franklin—Chesapeake Camp Corp., Franklin, plans to construct a paper plant. Estimated cost $500,000.

N. S., New Glasgow—Malagash Salt Co., New Glasgow, plans to construct a plant. Estimated cost $60,000.

Que., Montreal—Ciba Co., Ltd., 759 Victoria Sq., has acquired a garage at Monique and Cathcart Sts., and plans to convert it into a plant for the manufacture of dyestuffs and pharmaceuticals. Estimated cost $200,000.

Que., Montreal—Stuart Bros. Co., Ltd., 202 Youville Sq., plans to construct an addition to its factory for the manufacture of essential oils. T. Prangle & Co., Ltd., 485 McGill St., Engr. Estimated cost $40,000.

CONTRACTS AWARDED

Calif., Berkeley—Manasa Block Tanning Co., Ltd., 1300 4th St., has awarded the contract for additions to its plant to J. J. Moore Co., 354 Hobart St., Oakland. Estimated cost $45,000.

Conn., New Haven—New Haven Tobacco Co., 158 State St., has awarded the contract for a 2 story, 70x100 ft. warehouse to Brooklawn, Inc., 304 Edgewood St. Estimated cost $50,000.

Conn., Watertown—Watertown Manufacturing Co., Echo Lake Rd., has awarded the contract for a 2 story resin manufacturing plant to Robert L. Vaill & Co., 56 Echo Lake Rd. Estimated cost $40,000.

Ill., Chicago—Abbott Laboratories, Inc., North Chicago, has awarded the contract for a 2 story, 180x200 ft. pharmaceutical plant to W. E. O'Neil Construction Co., 2751 North Clybourn Ave., Chicago. Estimated cost $250,000.

Ill., Chicago—Nubian Paint & Varnish Co., 185 North LeClaire Ave., has awarded the contract for a 1 story, 60x120 ft. plant addition to E. I. Leander Co., 228 North La Salle St. Estimated cost $70,000.

Ill., Glenview—Baxter Laboratories, 923 Waukegan Rd., have awarded the contract for a 1 and 2 story addition to plant and laboratory to Freevol-Smedberg Co., 5950 West Erie St., Chicago. Estimated cost $75,000.

Ill., Monsanto—(br. East St. Louis)—Monsanto Chemical Co., 1700 South Second St., St. Louis, Mo., has awarded the contract for superstructure of 1 story, 134-182 ft. plant for War Dept. to Boaz-Kiel Construction Co., 4030 Chouteau Ave., St. Louis. Estimated cost $400,000.

Kan., Baxter Springs—Military Chemical Works, Inc., subsidiary of Pittsburgh & Midway Coal Mining Co., 1004 Baltimore St., Kansas City, Mo., has awarded the contract for constructing Jayhawk Ordnance Works for War Dept. to Freeto Construction Co., Pittsburg, Kan., and F. H. McGraw & Co., 780 Windsor St., Hartford, Conn. Chemical Construction Corp., 30 Rockefeller Plaza, New York, N. Y., will design and supervise construction and supervise operation until plant is in full production. Estimated cost of construction $10,193,600; equipment $6,513,100

La., Lake Charles—Mathieson Alkali Works, Inc., 60 East 42nd St., New York, N. Y., has awarded the contract for constructing a magnesium plant to have an annual capacity of 36,000,000 lb. for War Dept. to M. W. Kellogg Co., 225 Bway., New York, N. Y. Defense Plant Corp., will finance. Estimated cost $16,000,000.

Md., Baltimore—Davison Chemical Co., Curtis Bay, has awarded the contract for a 1 story addition to its plant to Rust Engineering Co., Clark Bldg., Pittsburgh, Pa. Estimated cost $50,000.

Mo., St. Louis—Mallinckrodt Chemical Co., Second and Mallinckrodt St., has awarded the contract for a 1 story warehouse to James Black Masonry & Contracting Co., 317 North 11th St. Estimated cost including equipment $40,000.

N. J., Bayonne—Standard Oil Co. of New Jersey, 26 Bway, New York, N. Y., plans to improve its oil refining plant at Constable Hook. Work will be done by owner. Estimated cost $40,000.

N. J., Fords—Heyden Chemical Co., 50 Union Sq., New York, N. Y., has awarded the contract for a 4 story chemical factory to M. Riesz, 871 King Georges Rd. Estimated cost $70,000.

N. J., Hanover—Maltbie Chemical Corp., 240 High St., Newark, has awarded the contract for a laboratory and manufacturing building to Sturgis Bros., 22 Garden St., Morristown.

N. J., Jersey City—Colgate-Palmolive Peet Co., 105 Hudson St., has awarded the contract for altering its factory on Sussex St., to Turner Construction Co., 420 Lexington Ave., New York, N. Y. Estimated cost $50,000.

N. J., Jersey City—Metro Glass Co., 135 West Side Ave., has awarded the contract for additions and alterations to existing warehouse to G. Siegler, 26 Journal Sq. Estimated cost will exceed $40,000.

N. J., Jersey City—Richards Chemical Works, 190 Warren St., Jersey City, has awarded the contract for a 2 story, 63x100 ft. addition to its plant to Hudson Concrete Construction Co., 454 Montgomery St., Jersey City.

O., Cincinnati—National Distillers Products Corp., 7818 Anthony Wayne Ave., has awarded the contract for a 103x208 ft. distillery to Frank Messer & Sons, Inc., 2515 Burnett Ave. Estimated cost $200,000.

Okla., Choteau—War Dept., Wash., D. C., has awarded the contract for engineering and architectural services, construction, acquisition and installing equipment, option for training key personnel and operating Oklahoma Ordnance Works, to E. I. du Pont de Nemours & Co., Du Pont Bldg., Wilmington, Del. Estimated cost of construction $45,982,478; equipment, $14,023,800.

Pa., Kittanning—Linde Air Products Co., subsidiary of Union Carbide & Carbon Co., 30 East 42nd St., New York, N. Y., has awarded the contract for a manufacturing plant here to James Stewart & Co., 230 Park Ave., New York, N. Y. Estimated cost $1,500,000.

Tenn, Cordova—National Fireworks Co., West Hanover, Mass., has awarded the contract for design and construction of plant to manufacture anti-aircraft ammunition at Cordova near Memphis, Tenn., to Foundation Co., 120 Liberty St., New York, N. Y. Estimated cost $500,000.

Tex., Freeport—Dow Chemical Co., Freeport and Midland, Mich., has awarded the contract for a magnesium plant to Austin Co., Stone & Webster Eng. Corp. and M. W. Kellogg Co., M & M Bldg., Houston. Defense Plant Corp. will finance. Estimated cost $52,000,000.

Tex., Texarkana—Lone Star Defense Corp., c/o B. F. Goodrich Co., 500 South Main St., Akron, O., has awarded the contract for expanding shell loading plant facilities here for War Dept. to Winston Bros. Co., 1470 N. W. Bank Bldg., Minneapolis, Minn., C. F. Haglin Sons Co., 720 National Bldg., Minneapolis, Missouri Valley Bridge & Iron Co., Leavenworth, Kan., Sollitt Construction Co., South Bend, Ind. and Brown & Root, Inc., 4300 Calhoun Rd., Houston. Estimated cost $3,500,000.

Wis., Beloit—C-Z Chemical Co., 1447 Orgall St., has awarded the contract for a 1 story, 50x300 ft. chemical plant to Fred Froebel, Beloit.

Ont., Pembroke—Consolidated Paper Corp., Ltd., 1615 Sun Life Bldg., Montreal, Que., will reconstruct its plant with its own forces. Estimated cost $98,500.

Ont., Windsor—Union Gas Co., Ltd., 185 West Chatham St., has awarded the contract for an addition to its plant to Robertson Construction, Ltd., Imperial Bank Chambers. Estimated cost $40,000.

Que., Kilmar—Canadian Refractories, Ltd., 606 Cathcart St., Montreal, will remodel its mill by day labor. Estimated cost $40,000.